DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

MAY, 1942

June MACHINERY will feature a comprehensive system by which a prominent manufacturer in a non-metal-working industry has trained the company's regular employes to produce Precision Metal War Products. Another feature article will deal with the machining of light-weight reciprocating parts for high-speed locomotives equipped with roller bearings, involving many unusual operations that may suggest methods for use in other fields as well.

Volume 48
Number 9

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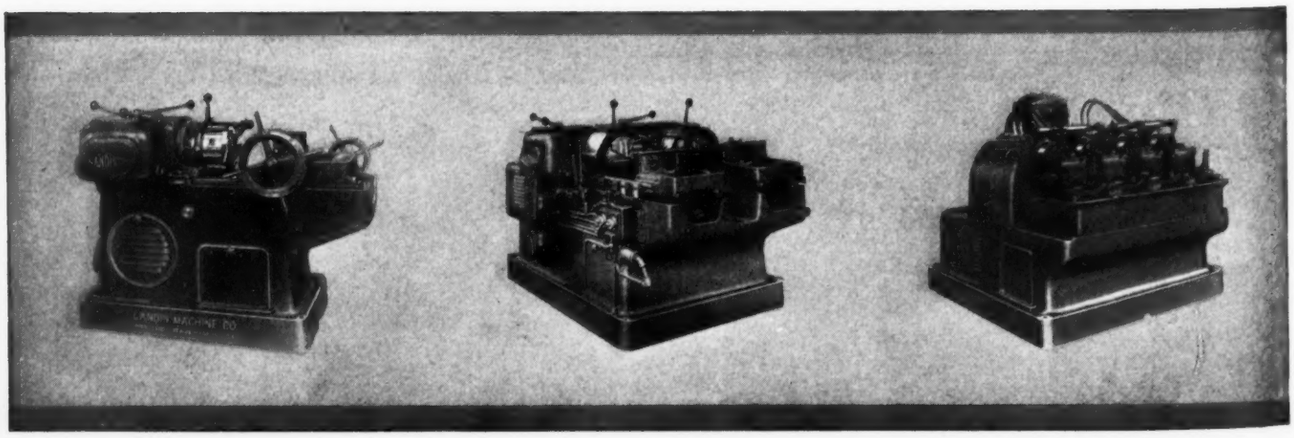
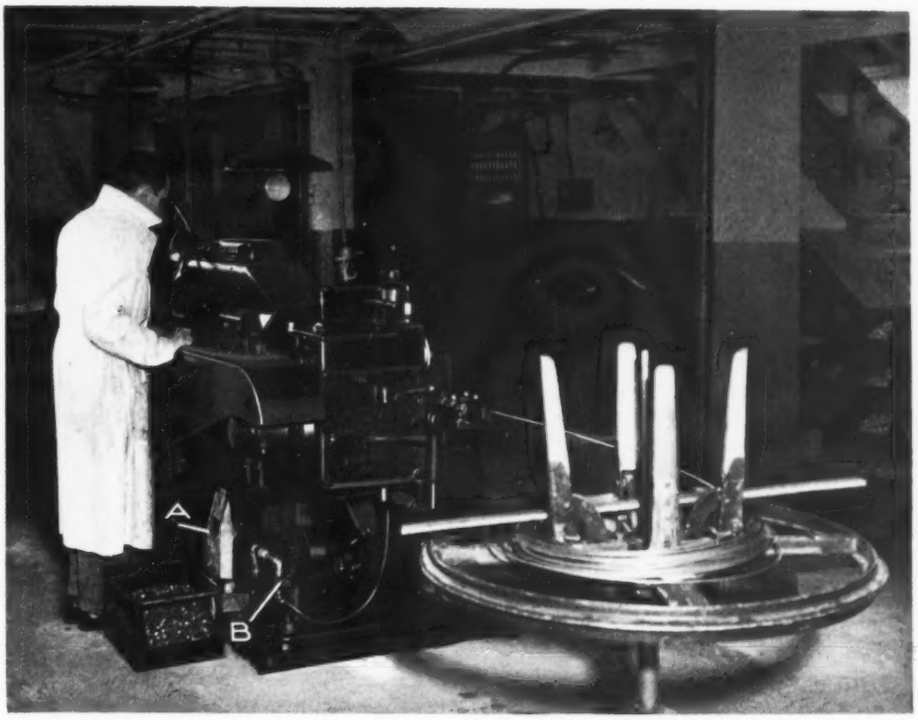


MACHINERY

Volume 48 NEW YORK. MAY, 1942 Number 9

Manufacturing Rivets for Airplanes

By M. W. SEAVEY, Tool Design Department
Lockheed Aircraft Corporation



Small in Size and Simple in Design, the Airplane Rivet, Nevertheless, Has Been the Subject of Extensive Experimentation. This Article Describes Step by Step the Manufacture of This Vital Part—First of Two Articles

Approved for Publication by the War Department

HOW many rivets are there in an airplane? A surprisingly large number. In the Lockheed-Hudson bomber, for example, there are 163,800. In addition to the large quantities required, further complications arise from the fact that several types of rivets, of different materials and various lengths, are utilized. It would be well, therefore, to get a clear picture of the airplane rivet itself before discussing the process of manufacture.

The general types of rivet heads — button, round, brazier, flat, and flush — are shown in Fig. 1. The symbols placed on the heads for identification, the material designations, and the minimum shearing strengths are given in Fig. 2. These rivets are manufactured in sizes varying by 1/16 inch up to and including 1 inch, and in larger sizes varying by 1/8 inch. As shown in Fig. 3, they are chamfered on the end to facilitate insertion in the holes they are to fit.

It is necessary to identify the rivets, as shown in Fig. 2, in order that the inspector can readily make sure that the rivet used is in accordance with the specifications on the part drawing.

The seemingly slight differences in the shapes of heads might cause one to wonder if the use of all these types by any one manufacturer is warranted. In this connection, it may be of interest to note how the airplane rivet was developed. Originally, this rivet was an adaptation of the rivet used in the steel industry, which was the button-head type. In an effort to reduce skin friction on the exterior of airplanes, a smoother surface became the objective, and, consequently, a rivet of less head height was designed. Then, in slow progression, successive types of rivets were designed with heads reduced in height until the flush rivet was established as a standard for exterior skins.

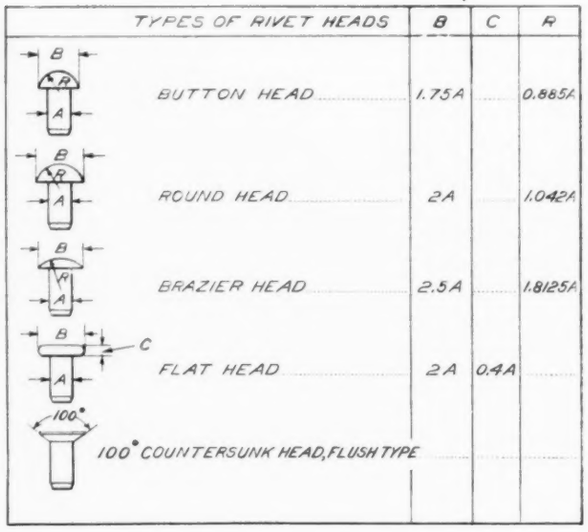


Fig. 1. Different Types of Rivet Heads

A recent standardization program at Lockheed established the flush rivet as standard for practically all exterior work, and the round-head rivet for all interior construction. The modified brazier-head rivet was retained for certain exterior applications where the use of the flush rivet would be either impractical or impossible. The number of materials was reduced to three: A-17ST for rivets up to and including 5/32 inch in diameter; 24ST for rivets 3/16 inch in diameter and over; and 2S for rivets used in gasoline and oil tanks, where the complete head of the rivet is later welded into the structure.

It might be well to explain at this time just how rivet designations are written. Take, for example, the symbol AN430-DD-6-10. AN stands for Army and Navy approved types. The numbers following the AN are the catalogue numbers. The letters following these represent the kind of material from which the rivet is to be made. The next number indicates the diameter of the rivet in thirty-seconds of an inch and the following number represents the length of the rivet in sixteenths of an inch. Thus, AN430-DD-6-10 designates a round-head rivet made from 24ST material, 3/16 inch diameter, and 5/8 inch long. If instead of the AN preceding the symbol, NAS 1 is used, it indicates that the rivet is of the type approved by the National Aircraft Standards Committee.

One of the machines used in making rivets is shown in Fig. 4. This machine is built by the National Machinery Co., Tiffin, Ohio. It has a built-in electric motor drive and a variable-speed mechanism, known as the U. S. Vari-Drive unit, manufactured by U. S. Electrical Motors, Inc., Los Angeles, Calif. These rivet-making machines are mounted on steel bedplates which have a steel channel welded to them to collect oil seepage and prevent it from spreading out over the floor. These bedplates are, in turn, mounted on solid cement block foundations approximately 3 feet deep.

The rolls of wire from which the rivets are made are mounted on special stands made of aluminum castings. These rolls are supported on ball bearings, so that a very light pull on the wire will cause them to unwind easily. This

RIVET DESIGNATIONS			
IDENTIFICATIONS	TYPE	MATERIAL	MIN. SHEAR
RAISED CROSS	M	AM565	X
PLAIN	A	2S	X
RECESSED DOT	AD	A17ST	27,000
RAISED DOT	D	17ST	30,000
RAISED DOUBLE DASH	DD	24ST	35,000

Fig. 2. Identification Markings for Rivets

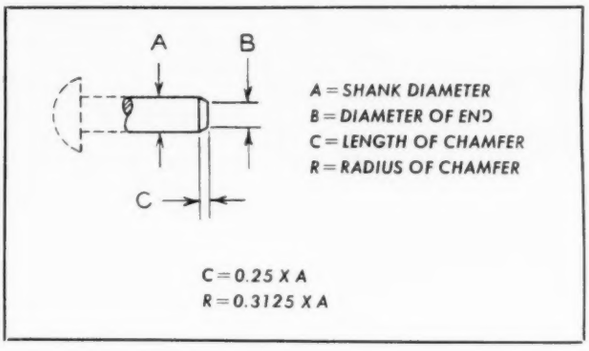


Fig. 3. Proportions of Rivet Chamfer

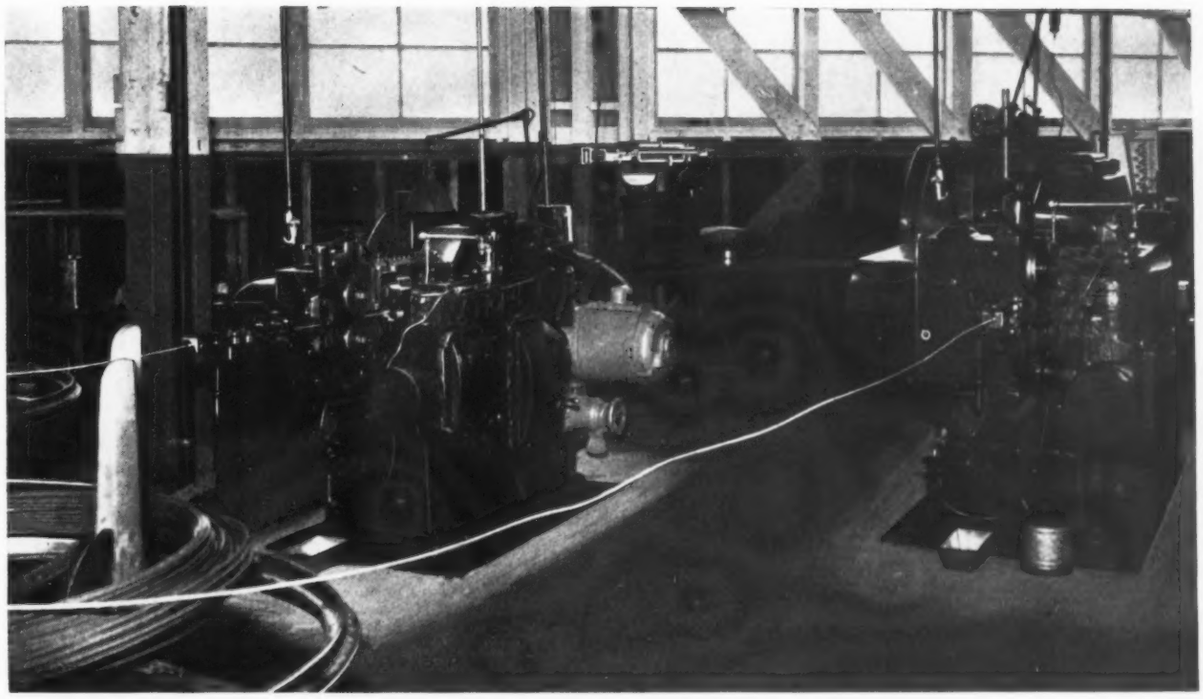


Fig. 4. National Machinery Rivet-forming Machines with Built-in Motor and U. S. Vari-Drive Unit

helps to eliminate any possible damage to the wire, which might prevent it from feeding through the dies.

The wire used is slightly smaller in diameter than the finished rivet size. This allows the blank cut off from the wire to slip easily into the finishing die insert. The insert, which has the form of the finished rivet, is made to the minimum size when new, so that allowable wear can occur up to the maximum diameter before the insert must be discarded. The size of the rivet blank, therefore, is small enough to enter the die insert when it is minimum size.

Coming off the reel, the wire first reaches an

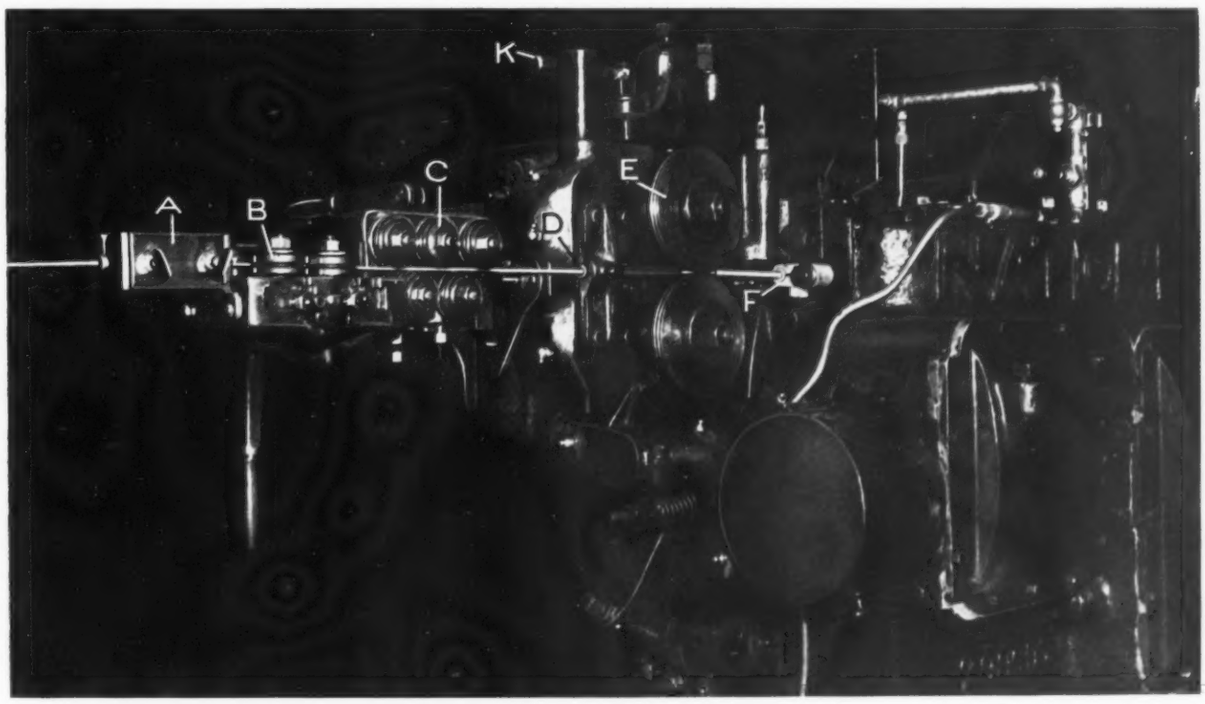


Fig. 5. View of Machine in Fig. 4, Showing End where Wire Enters, and Straightening and Feed Rolls

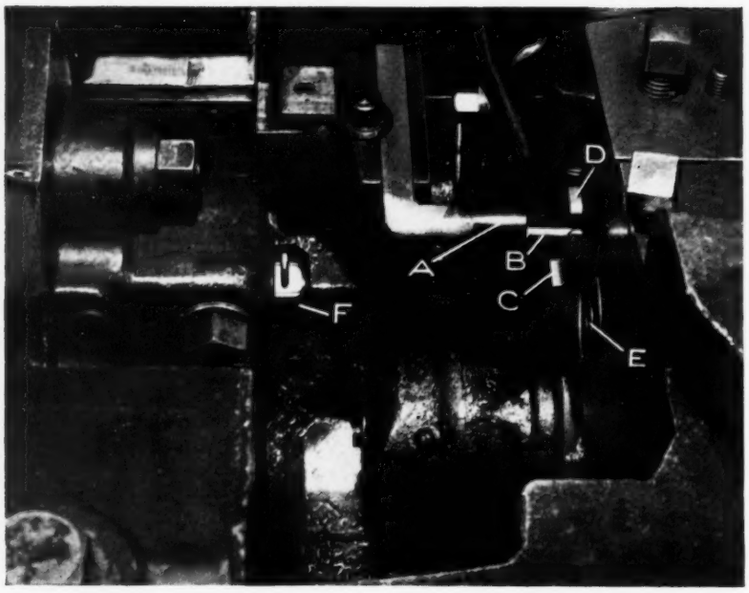


Fig. 6. Close-up View of Rivet-forming Machine, Showing Wire Held between the Tool D and Finger C while being Sheared against Edge of Quill (Not Visible)

VICTORY

oiling device consisting of two felt pads under spring pressure, as shown at *A* in Fig. 5. Sometimes, in handling, the wire may become bent; and since it comes in rolls, there is a curve in it. It is necessary, therefore, to straighten the wire at this stage, in order that subsequent difficulties may be avoided. This is accomplished by passing the wire through rolls *B* and *C* which are adjustable and which have a groove in them of the same diameter as the wire. As shown in the illustration, these rolls are arranged in both horizontal and vertical positions.

The wire continues on through the feed-roll guide tube shown at *D*, and is guided to the correct groove in the feed-wheels. It now passes through the upper and lower feed-wheels *E*, which feed the wire forward the correct amount to make a rivet blank. These feed-rolls can be released or opened up to insert the wire by lever *K*.

The wire now enters another guide tube *F* and then travels through the machine and through the cutting-off quill, which is located just to the right of the cutter blade shown at *D* in Fig. 6. The quill may be seen at *D* in Fig. 7. These quills are made with sintered-carbide inserts of Vascoloy Ramet Grade 2A68. The inserts can be seen more clearly at *C* in Fig. 14.

Since the end of these inserts is ground at an angle of 3 degrees and has a definite relation to

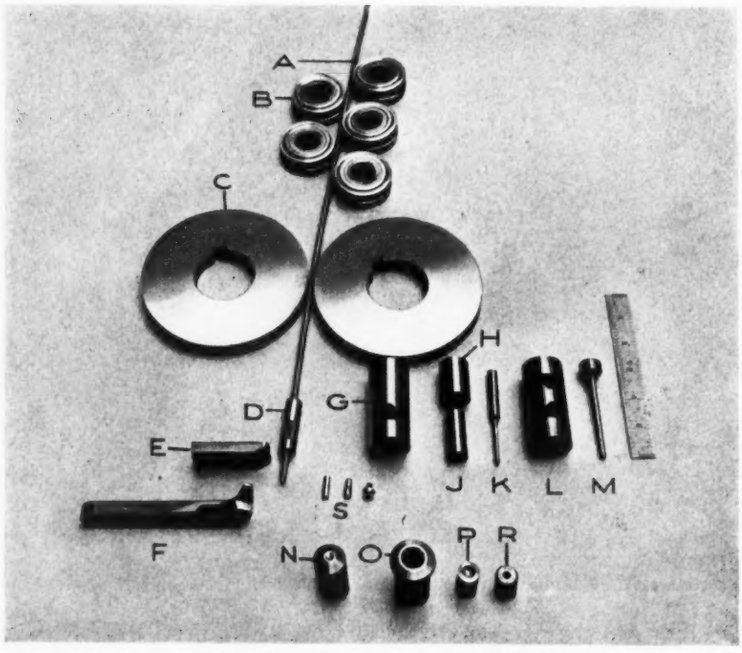


Fig. 7. Various Parts of Rivet-forming Machine: Straightening Rolls B; Feed-rolls C; Cutting-off Quill D; Cutting Tool E; Holding Finger F; Die Insert Holders G and L; Die Insert Back-up Block H; Die Insert J; Ejector-pins K and M; Heading Punches and Accessories N, O, P, and R. Three Stages of Rivet Formation are Shown at S

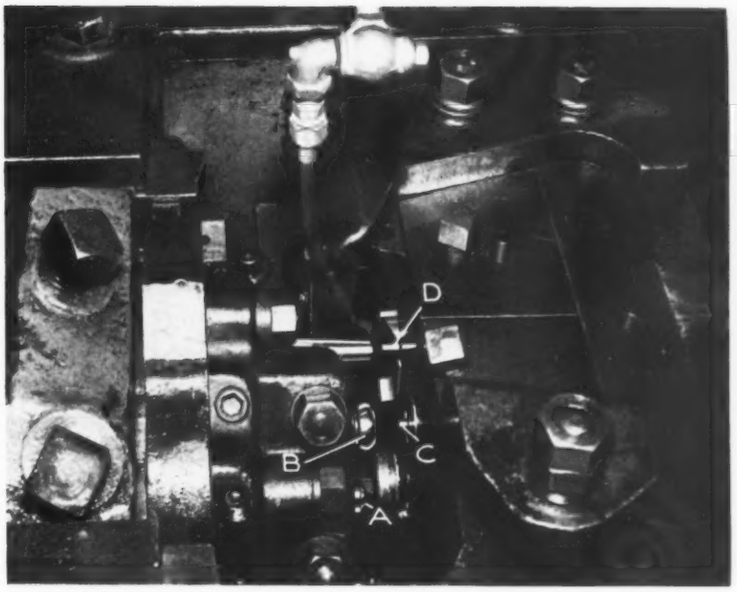


Fig. 8. Rivet Blank C in Die Insert, Ready to be Headed in Two Operations by Coning Punch A and Finishing Punch B. Wire is being Advanced at D to Form New Blank

VICTORY

the flat slot in the holder, it was necessary to make a holding block to hold the inserts while sharpening or grinding the quills. This is shown at *A* in Fig. 14. Both the small- and large-diameter quills *B* and *C* can be ground in the same holder. For grinding either the quills or the cutters, it is necessary to use a diamond-impregnated wheel.

After passing through the cutting-off quill, the wire is fed on past the cutter blade *D* and up to the positive stop shown at *A* in Fig. 6. This stop can be adjusted by a knob (not shown). As soon as the wire has come against the stop, blade *D* starts forward, cutting the wire with a shearing action. In order to keep the wire from being deformed, a cutter with the form of the wire is used. This feature can be seen in detail in Fig. 12.

The cutters shown at *F*, *G*, and *H*, Fig. 12, are used in a 3/16- by 2 1/2-inch double-stroke machine, and cutters *C*, *D*, and *E* are used in a 5/16- by 2 1/2-inch double-stroke machine. In case of emergency, it is possible to run the smaller rivets in the larger machine by using adapter *B*. The illustration shows the different types of cutters—short, medium, and long. The short cutter is, of course, used in making short rivets. When the rivet blank is longer, it becomes necessary to support the blank, and then the medium-length cutter is used. For long

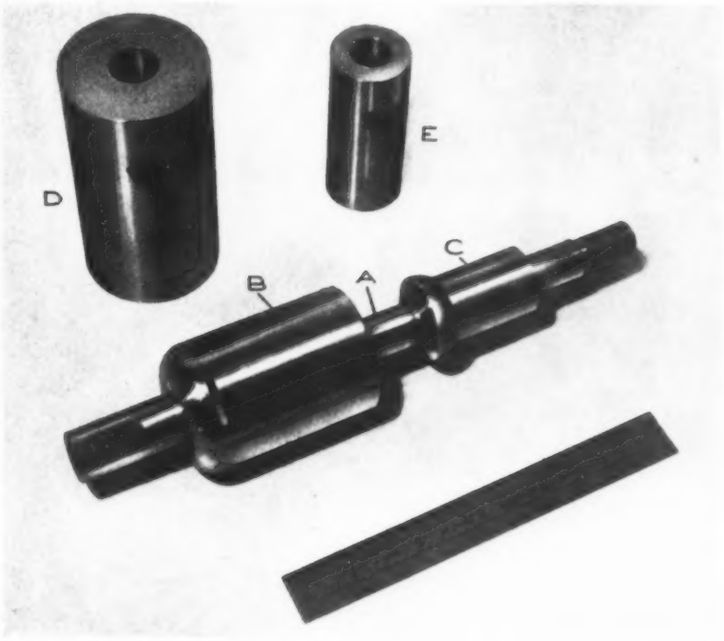


Fig. 9. Two Sizes of Punch Adapters B and C Mounted on Mandrel A Ready for Grinding. The Illustration Also Shows Two Sizes of Die Insert Holders D and E

VICTORY

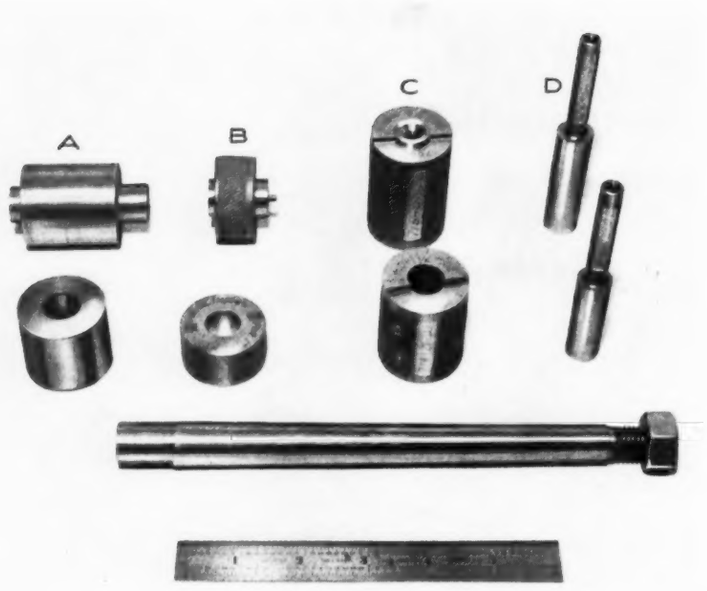


Fig. 10. Ring Gages C for Checking Punches as at B, and Plug Gages D for Checking Adapters as at A

rivets, the long cutter is employed to support the rivet blank.

As millions of rivets are cut, it is desirable to make these cutters of the very best material available. With high-speed steel, the Dural wire seems to have an affinity for the steel and loads up or galls. Therefore, the cutters are made with sintered-carbide inserts of Vascoloy Ramet Grade 2A68. These inserts are brazed into the cutter blanks which are made from Max-El 3 1/2 steel.

When the cutter starts to move forward, a carry-over finger comes up and holds the rivet blank in the cutter blade. The carry-over finger is shown at *C* in Fig. 6 holding the rivet blank *B* in place, and has already started to move away from stop *A*. This carry-over finger is held in place under spring pressure, and follows the cutter and rivet blank over into a position directly in front of the finishing die insert, as indicated at *E*.

For details of the carry-over finger, see Fig. 13. Fingers *A*, *B*, and *C* are for the 5/16-inch machine, while *D*, *E*, and *F* are for the 3/16-inch machine. These carry-over fingers are made in short, medium, and long lengths for the different length rivets, similar to the cutters. They are made from S A E 4130 steel, and are heat-treated for greater strength.

As soon as the cutter and carry-over finger

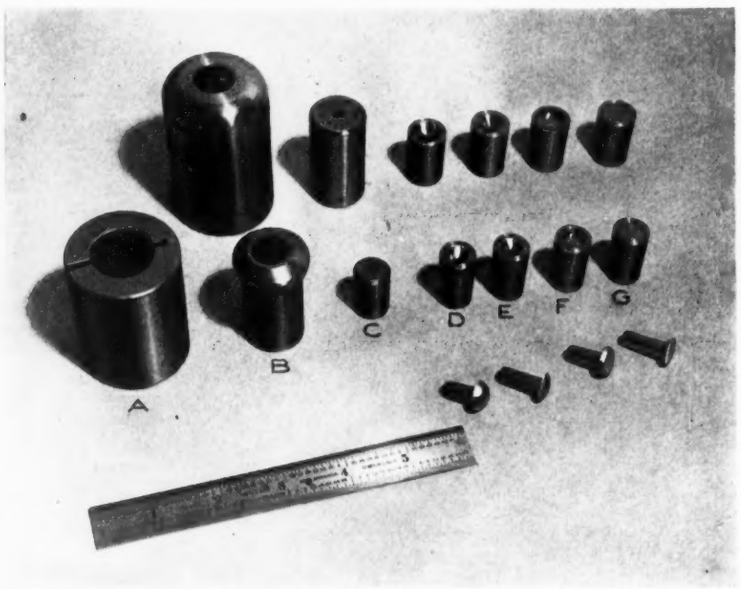


Fig. 11. Various Sizes of Punch Adapters, and Different Types of Punches Used in Producing the Rivet Heads Shown

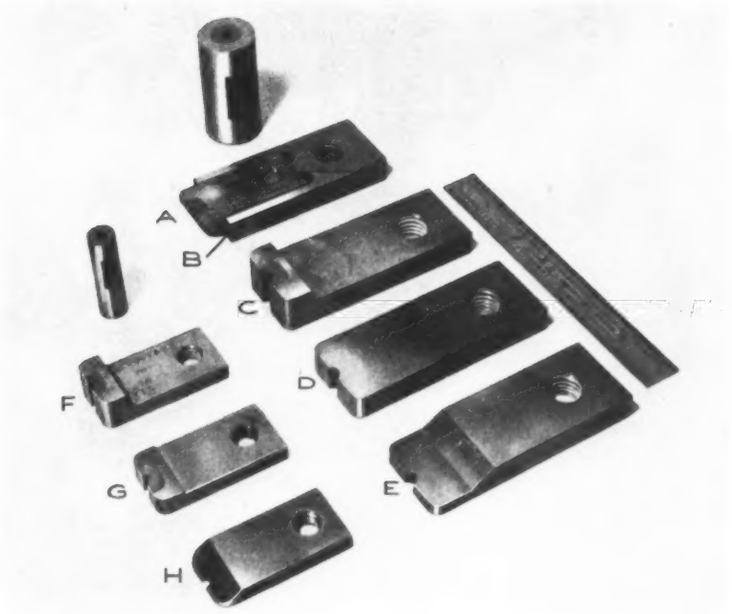


Fig. 12. Long, Medium, and Short Cutting Tools F, G, and H are Used on 3/16- by 2 1/2-inch Machine, and C, D, and E are Used on 5/16- by 2 1/2-inch Machine. A is a Small-size Cutter Held in Adapter B for Use on a Larger Machine

have placed the rivet blank in front of the die insert, the machine ram starts forward. Mounted on the end of this ram is a casting that holds the coning and finishing punches, shown at *A* and *B*, respectively, in Fig. 8.

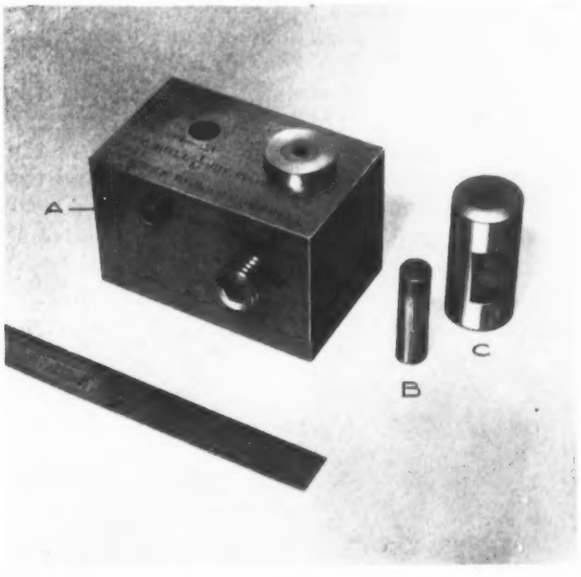
A more detailed view of the coning punch may be seen at *N* in Fig. 7. The finishing punch assembly consists of an adapter *O*, finishing punch insert *P*, and a backing-up block *R*. The parts illustrated are for the 3/16- by 2 1/2-inch machine. A different size die insert *J* is required for each diameter rivet. Also a different punch insert *P* is used for each material from which the rivets are made, because the finishing punch finish-forms the head of the rivet and puts on the identification marks.

Finishing punches *D*, *E*, *F*, and *G* are shown in Fig. 11. These punches are expensive, and, therefore, are made as small units. The outside diameter is tapered 1/4 inch per foot. These punches are checked with a ring gage *C*, Fig. 10.

The finishing punch insert *P* is pressed into adapter *O*, Fig. 7. The hole in the adapter is ground to fit the plug gage *D*, Fig. 10. The adapter is mounted on mandrel *A* shown in Fig. 9, and this assembly is placed in a wet cylindrical grinder, where the outside diameter is ground to size. This leaves the hole concentric

Fig. 13. Short, Medium, and Long Holding Fingers for 5/16- and 3/16-inch Machines

Fig. 14. Block A for Holding Cutting-off Quills B and C while Grinding Them



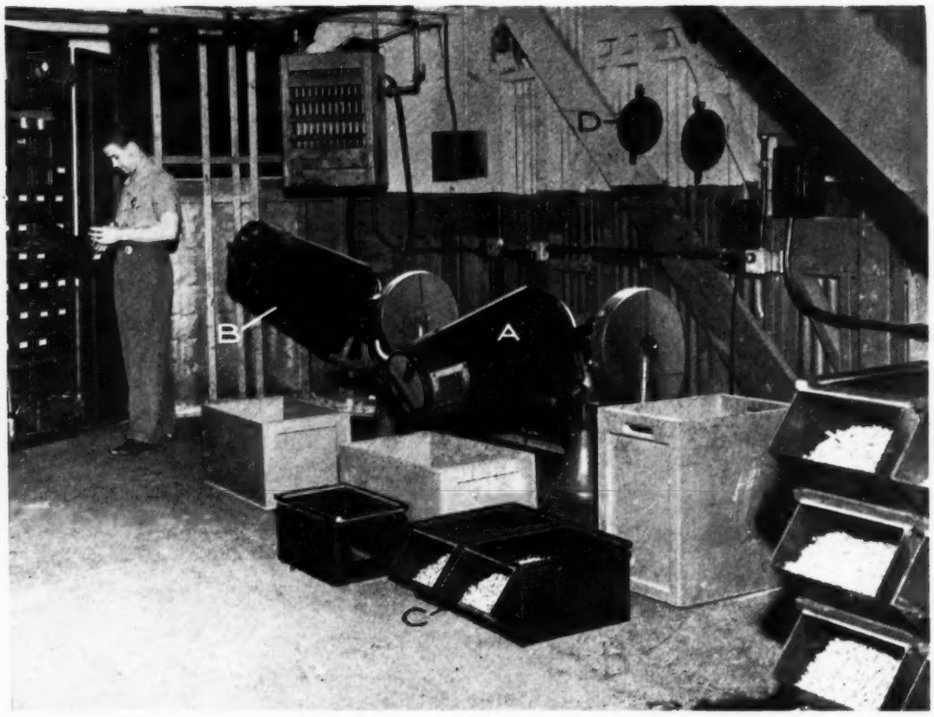


Fig. 15. Tumbling Barrels for Removing Flash from Rivet Heads after Forming Operation

with the outside diameter and, therefore, the adapter requires no special setting in the machine.

The punch insert is made slightly larger than the hole in the adapter to achieve a press fit. The correct amount is built into the gages. Because the amount of taper is so slight and such great pressure is required in finish-forming the head of the rivet, it might be possible that the insert would move further into the holder while in use. To prevent this, the correct length backing-up block *R*, Fig. 7, is selected. This fits into the holder just behind the punch insert. In order to facilitate removal of the assembly on the large machine, a groove is ground in the adapter, as can be seen at *B* in Fig. 9 and at *F* in Fig. 6.

The coning punch moves into contact with the rivet blank and punches it into the die insert. As soon as it enters far enough to support the blank, the carry-over finger drops down and the cutter starts to recede. The rivet blank continues into the die until it reaches the bottom. The coning punch continues to travel forward, partially upsetting or coning the head. The ram then recedes, and the finishing punch is brought into the correct position. The ram proceeds forward on the next stroke of the press, coming into contact with the coned rivet blank, and continues forward, completing the rivet head shape and identification marks.

The three stages of manufacturing the rivets —the blank, coned blank, and finished rivet— are shown at *S* in Fig. 7.

A clearance of 0.002 inch is left between the finishing punch and the die insert for any excess metal to squeeze out on all sizes of rivets over 1/8 inch diameter, while 0.001 inch is left for the 1/16- and 3/32-inch diameters. This excess metal is called "flash." The flash is removed by putting the rivets into a tumbling barrel with hard wood sawdust. Fig. 15 shows rivets in the boxes ready to be tumbled at *C*. The position of the barrel while tumbling the rivets is shown at *B*. After the flash has been removed, the barrel is lowered while it is still running. This allows all the sawdust and flash to fall out through the screens on both end and sides, as shown at *A*. Different mesh screen caps are used for different sized rivets. Some of these are shown hanging on the wall at *D*.

VICTORY

Converting a Linoleum Plant to Produce Shells, Bombs, and Aircraft Parts

The Changing over of a Metal-Working Plant to War Work Presents Many Problems, but the Conversion of a Non-Metal-Working Plant is a Real Engineering Achievement

Approved for Publication by the War Department

EVERYWHERE we hear references to conversion of plants to war work. Frequently the word "conversion" is used when the change involves mainly applying new jigs, fixtures, or tools to present equipment. This is merely a simple change-over from the making of one product to another, a change-over familiar to every jobbing shop. The real conversion problems are met with when plants making products wholly foreign to metal-working turn over their organization and buildings to metal-working operations; and especially is there a real conversion job when machines originally built for non-metal manufacture are ingeniously adapted to turn out metal products.

One of the outstanding examples of this kind of conversion is presented by a company that owns a dozen plants throughout the country, the principal one of which manufactures linoleum, while another makes bottle caps and plastic products. This company has turned a large percentage of its facilities over to war production, including the making of shells, bomb cluster adapters, and airplane parts. New contracts are constantly being obtained, and more and more, the company's facilities are being devoted to war work.

Problems to be Solved in Converting a Plant to War Production

It is obvious that a great many problems have to be solved in carrying out such a conversion enterprise. Equipment not suitable for metal-working has to be removed from the buildings, and machine tools and other metal-working equipment, heat-treating furnaces, materials-handling devices, etc., have to be installed. In some instances, however, most ingenious application has been made of present equipment. In the making of linoleum, a continuous "sheet" of floor covering passes under huge hydraulic presses. Some of these presses no longer are engaged in the work for which they were designed; today they are pressing out aluminum aircraft wing tips. This is but one example of the application of equipment built for entirely different purposes now being applied to metal fabrication.

Another difficult problem being solved is that of training operators for machine tools. Linoleum workers who, perhaps, had never seen a turret lathe before, are now operating these machines on shell work; others do tool grinding, electric welding, or press work. This company had one valuable advantage in connection with the conversion of its plants to metal-working and in the training of its men. It has always operated a fair-sized machine shop for its own use, where the special machinery employed in manufacturing its regular lines was built and where dies and tools employed in its factories were made. Hence, it had in its employ a group of highly skilled men—toolmakers and machinists—who were used to precision work, because, contrary to what might be assumed, the machinery that cuts out the intricate patterns in which linoleum is made must be made with a precision as great as that required in any machine tool. In connection with this work, the company had also a highly trained engineering department. Around this nucleus of engineers and skilled workers its war production has been built.

In addition to the work carried out in the company's own plants, it is doing a great deal of sub-contracting. It should be noted, however, that this sub-contracting is not done so much because the company's own facilities are occupied to capacity, but rather to comply with the request of the Government to sub-contract whenever possible and keep the smaller shops going.

The experience of this company in converting its facilities to war work will prove of value to other manufacturers similarly situated, and for that reason a detailed account of the problems with which it has been confronted will be given and its training methods will be explained; the object being simply to speed up and facilitate war work on the part of other plants.

Bidding for a War Material Contract

When a firm decides to convert its facilities to war production, the first thing is to obtain a contract that the organization is capable of handling. One of the difficulties of an inexperienced concern is the bidding. As a rule, an inexperienced bidder does not dare to specify too low a figure for fear of serious financial loss. He may not be in a position to assume such a loss; yet when he bids too high, he does not get the contract.

It has been suggested that a larger number of firms would be eager to undertake war work if they could take it on the basis of limiting their profits to a certain percentage. This is not the "cost plus 10 per cent" plan, which is considered to encourage inefficiency and waste, but is a plan where a maximum cost is stipulated from the beginning and profits limited if the contract is completed below that figure. On that basis, everybody capable of taking a war contract could bid and the Government would not need to fear that exorbitant profits would result in the case of high bidders.

It has also been suggested that, in many instances, contracts could and should be given out without bids. In that way, all industry could be put at work. Large contracts, like those for tanks and aircraft, are now being negotiated with selected concerns. The same procedure could be followed in practically all contracts for material that the Government has had made in the past, because it is known in advance what is a reasonable price. This would include such items, for example, as shells. It would save the time and effort of the engineers in hundreds of plants that now must devise methods and figure costs for bids, although ultimately only perhaps two or three of the bidders receive a contract. These engineers, in the present grave emergency, could use their time to much better advantage in actual production work. The change from bids to negotiated contracts is now being gradually carried through by the Government.

In one instance, one firm employed seven engineers for eight weeks in preparing methods for the manufacture of an item of which 20,000,000 were needed. Assuming that there were thirty bids in each of five districts, there were 150 bidders in all; and if everyone did as thorough a job as in the case mentioned, then there was an enormous waste of engineering time and talent, since only a small number of the bidders actually received a contract. In fact, it has been estimated that, in this case, the work preliminary to the bidding actually used the time of thirty-five engineers for one full year. We cannot afford that kind of waste in this emergency. There is one point that every inexperienced bidder must recognize: He is not going to get a contract each time he bids for one. Usually he may have to bid from six to ten times in order to get one contract.

Another thing that an inexperienced bidder should realize is that the Army and Navy Ordnance Offices must be careful to place orders with concerns reasonably well known to be responsible. The Ordnance officers have a grave responsibility, and cannot afford to take any chances in regard to the successful completion of a contract. There are many concerns that have demonstrated their ability to successfully carry out war work contracts and that have not yet been able to obtain business to the limit of their manufacturing capacity.

In some instances, corporations have been successful in obtaining contracts by actually redesigning the device on which they wanted to bid, so that it could be made cheaper and on equipment available in the prospective contractor's plant. The company under discussion did this successfully in one instance, redesigning a device used in aerial warfare so that it could be manufactured for 25 per cent of the cost of making it as originally designed. Other manufacturers have obtained contracts by similarly employing their initiative and ingenuity.

Surveying the Available Machine Tool Equipment

In considering bidding for war work, the important thing is to see that as much as possible of the machine tool and other equipment required is available. First, a survey is made of the equipment in one's own shop. Next, plants in the neighborhood are visited to find out whether additional required equipment is idle and can be acquired either by purchase or by using the plant having the equipment as a sub-contractor.

Finally, if some equipment is still lacking for the completion of the contract, what is required should be stated in the bid. This statement should be accompanied by the price of new equipment, quoted or estimated, and the time of delivery, as determined by inquiry from the machine tool builders. In case the bidder is successful, he obtains a priority on new equipment. Of course, the machine tool deliveries are accelerated by the Government in urgent cases. Finally, in quoting a price, give the figure that a careful cost estimate has determined; then leave it to chance whether you get the contract or not.

Do not promise delivery for a given date unless you have definite assurance of the required machines and material from the Government. Instead of giving a certain delivery date, some contractors find it advisable to word the delivery clause something like this: "Will begin to deliver a stated number of parts within fifteen

days after required machinery and materials have been delivered to the plant." Since the manufacturer himself has no control either of machine deliveries or material, this is the most satisfactory procedure.

The Government can be depended upon to assist in an early delivery of machines and materials in order that the contract will be filled. The additional machine tool equipment may either be paid for by the contractor himself or arrangements can be made to have it paid for by the Government, in cases where additional facilities are required that the manufacturer may not be able to use when the war is over.

Where operators have to be trained, this educational expense is usually allowed for by a higher price on the first contract. It is wise to prepare ahead for a possible contract award by selecting and training supervisors and men, so that they are ready to go to work as soon as equipment and materials are available.

Sub-Contracts versus Prime Contracts for Smaller Shops

One piece of advice that may prove useful to the small shop, especially, is that a sub-contract from one of the larger prime contractors in the vicinity may be more advisable than a direct contract from the Government. Generally, it is easier for a small shop to obtain a sub-contract than a prime contract. Furthermore, in the case of a sub-contract, the engineering experience and assistance of the prime contractor is available.

However, should a medium-sized or smaller shop think it advisable to obtain a prime contract, the best advice can be obtained (in the case of an Army contract) from the Army District Offices located in the larger industrial centers throughout the country, and (in the case of a Navy contract) from the Navy Ordnance Bureau in Washington. Do not go to Washington in the case of Army war work. The contract work is handled directly by the District Office in your section of the country. The District Offices give every possible aid to a prospective bidder to enable him to determine what he can do and what is required in entering his bid.

Do Not Expect to be Able to Handle a Munitions Contract as a "Side Line"

As regards the organization in a plant that has obtained a contract, it should be said that to carry on munitions work successfully in a shop that handles its regular business at the same time, a separate munitions organization is advisable. Whether that organization is large or small will depend upon the size of the shop, but the men who carry on the munitions work should be wholly independent of the regular industrial work going through the plant. Generally speaking, it has been found unsatisfactory to try to have the same men handle the two kinds of work at the same time.

The detail work in dealing with the Government agencies is very great; it is not like dealing with a commercial customer. For that reason, it is necessary to have men handle it who can give all their time to it and take care of it as a separate business. Do not expect to be able to carry on war contracts as a "side line."

Sub-Contracting a Prime Contract to Smaller Shops

When a great deal of the work is sub-contracted by a prime contractor to smaller firms, it is obvious that the cost of doing the work will be higher. As a rule, the smaller contractor cannot produce so efficiently as the larger shop; and even if in some instances he can, there is the additional cost of supervision by the prime contractor, inspection, transportation of materials and finished parts, duplication of tools, etc.

The fact that higher prices must be allowed contractors who employ a great many sub-contractors must be recognized by the Ordnance Offices, in order that the desire of the Government to employ as many of the smaller shops as possible may be realized. In one instance, for example, a company devised an elaborate program for distributing a contract among as many as thirty-five different smaller shops in the county. The cost of handling the work in that manner, however, was higher than if all the work had been done in one shop, and the contract was lost to a bidder who had planned to do the work that way. Of course, the Government should not pay more for work than is necessary; on the other hand, it is worth something to the nation to have the smaller shops, who cannot continue with their regular line of manufacture because of lack of materials, doing their bit in turning out war production.

In order to carry on successful sub-contracting with smaller shops, the prime contractor should, if possible, select shops that are near his own plant, so that he can give them adequate supervision. Small businesses with equipment that can be used for war work are waiting, as a rule, until someone comes to them with an order; hence, it becomes the prime contractor's business to find out what manufacturing capacity there is in the vicinity and study that manufacturing capacity in a systematic manner.

The first thing is to visit all the small shops in the neighborhood to find out what they are regularly doing and if they are in a position to take a sub-contract; then list and inspect the equipment available and index it in such a man-

ner that when a sub-contract can be handed out to a shop having that kind of equipment, it is given to this particular shop. In other words, a prime contractor who expects to do sub-contracting successfully must keep an index of all the equipment in all the shops in his locality.

A survey such as indicated may show that in a given locality no precision work could be done —only work requiring a limited degree of precision. In that case, the prime contractor should not bid for precision work. He must fit the job for which he bids to the machinery available in his locality. A prime contractor can expect that it will take him two or three months to make an adequate survey of the local plants and obtain a Government contract that will fit into the facilities available. The prime contractor should remember particularly that the smaller plants, as a rule, have shown little enterprise in obtaining war work. They must be located and the work more or less forced on them; but after they are started, experience shows that they give a very satisfactory account of themselves.

In many instances, the prime contractor must be prepared to finance these smaller shops, both as regards materials and as regards some additional equipment that they may require. As a rule, the larger concern that has a prime contract can be of real service, because it has engineering facilities that the smaller shops cannot afford.

An Example of Successful Sub-Contracting

As an example of what can be accomplished by utilizing good small sub-contractors, there is the case of the fabrication of a small unit having twenty parts and costing about $5 to manufacture. The work included blanking and forming in a press, wire forming, screw machine work from 1/4 to 7/8 inch in diameter, drilling, and spring-winding. Fourteen sub-contractors were engaged in machining and making parts, the prime contractor doing the assembly work only. Sixteen days after the receipt of the order, 200 units were delivered; three days later, 1000 units a day were completed and delivered. This rate of delivery was continued until the completion of the contract. In the period of sixteen days, from the receipt of the order to the first delivery, welders and other operators were trained and the tools required were made. The small plants proved so satisfactory in carrying out this contract that while at first 10 per cent scrap was anticipated, there was actually less than 1 per cent of rejections.

A prime contractor expecting to use some sub-contractors should always survey his district and locate his sub-contractors before he bids. He must be prepared to assist and help his sub-contractors even to the extent of indicating to them how to bid on their sub-contract, by telling them what the job is really worth.

The survey and contact with the small sub-contracting shops must be handled by the engineering department, since this is strictly an engineering and manufacturing job. The purchasing of the sub-contractor's services is, in this case, a mere detail. Do not expect that a successful sub-contracting business on war work can be handled through the regular purchasing department. There is too much engineering detail entering into the transaction to make that procedure successful.

In a coming number of MACHINERY, the methods by which one company has successfully trained men engaged in their regular lines of manufacture to become machine tool and welding machine operators, and to give a good account of themselves in various classes of war production, will be outlined.

* * *

Old Machine Tools Doing Their Bit

Twenty-five years ago an automobile plant in a Michigan city boxed up a battery of multiple boring machines, loaded them on flat cars, and shipped the tools to an affiliated plant in Toledo. Years later, the tools moved again, this time to Buffalo, where they were kept working until that plant shut down its automobile lines. The Michigan plant, in taking on a projectile job, recently found that multiple boring machines needed for the work could not be obtained in less than a year or more. Its engineers, in combing the tool lists of many plants for idle machines, spotted their old equipment of a quarter of a century ago. The tools are now back "home." Here they are being rebuilt—incidentally, at a cost greater than their original price —and soon will be engaged in war production.

* * *

Management Reports to Employes

Among the companies that are preparing a stockholders' report in clear and concise form, which report is also distributed to the company's employes, is the Farrel-Birmingham Co., Inc., Ansonia, Conn. The report for 1941 shows graphically the increase in production of the various lines built by the company; it gives, both in figures and in graphical form, a statement of how the company's sales dollar was spent during the year; and, in addition, it contains information on the amount of taxes paid per employe by the company, which, for 1941, amounted to $669 per employe.

The B&O Concentrates Production in One Shop

By W. S. EYERLY
Superintendent of the Mount Clare Shops

Second Installment of an Article that Outlines Economies Obtained in the Maintenance of Locomotives through the Centralization of Repair Part Production

AN article published in April MACHINERY outlined a considerable number of operations performed in the Mount Clare shops of the Baltimore & Ohio Railroad System, where the production of repair parts required over the entire system is concentrated. This concluding installment will describe several additional operations in the Mount Clare shops.

Large cylinder castings are completely drilled, reamed, and tapped by the Carlton radial drilling machine seen in Fig. 9, which was specially built with a column 12 feet high and an arm 8 feet long to accommodate work of large dimensions. The illustration shows a cylinder set up for drilling and tapping a valve-cage bolt-hole. Eight of these holes must be produced. In addition, forty-four cylinder-stud holes are drilled and tapped to a diameter of 1 1/8 inches; twenty-four valve-stud holes are drilled and tapped to a diameter of 7/8 inch; twelve steam-pipe joint holes are reamed, ground, and spot-faced on the bottom; six sight-plug holes are drilled and tapped to 1 3/4 inches pipe size; and four lubricating-plug holes are drilled and tapped to 1 1/2 inches. The jig rings used in drilling the cylinder and valve-head stud holes are seen resting against the right-hand end of the cylinder casting.

The operation illustrated in Fig. 10 consists of drilling, tapping, and spot-facing a total of sixty-eight holes in a superheater header of welded steel construction on which three steel

Fig. 9. Radial Drilling Machine Employed for Drilling, Reaming, and Tapping Approximately 100 Holes in Large-sized Cylinder Castings

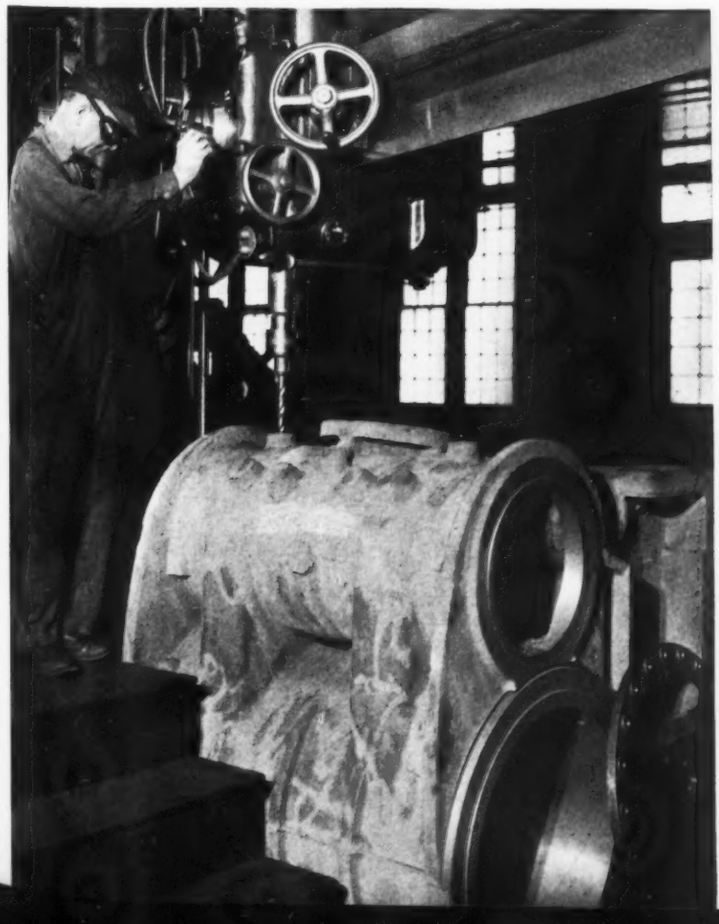
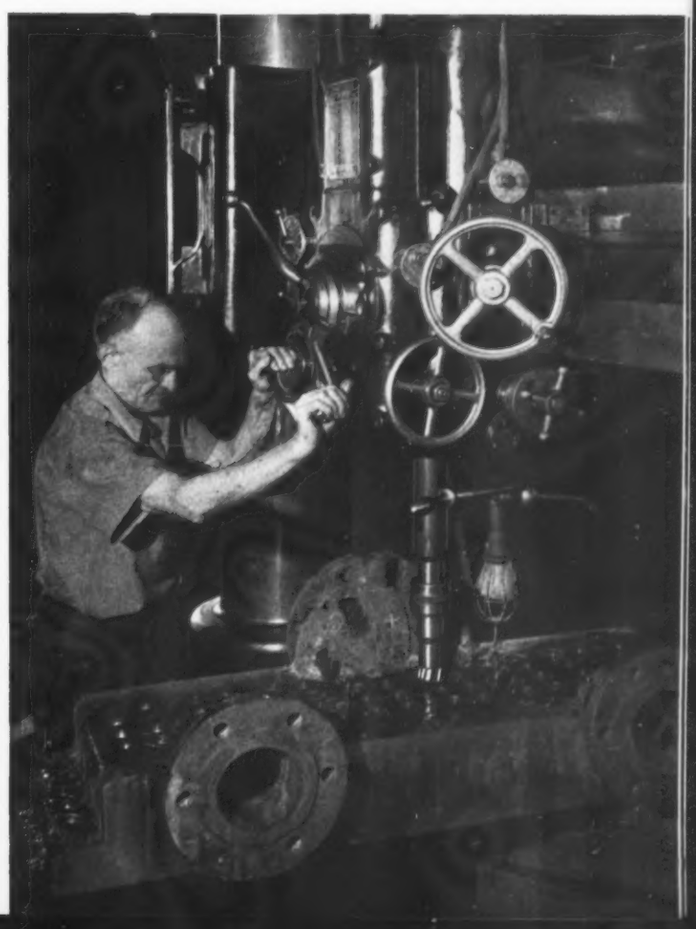


Fig. 10. Another Radial Drilling Machine Operation in which 68 Holes are Drilled, Tapped, and Spot-faced in a Superheater Header



castings are also welded. The holes are drilled and then tapped to 1 3/4-inch pipe size. After tapping, a spot-facing tool is applied as shown. A white-lead and black-oil mixture is used as a lubricant. The machine used for this operation also is a Carlton radial drilling machine.

The openings for the crankpin bushings in the ends of main- and side-rods are trepanned from the solid stock by the use of tools such as seen on the right-hand spindle of the Baker drilling and boring machine shown in Fig. 11. When the rods reach this machine, holes 2 1/2 inches in diameter have already been drilled through them and reamed. These holes were produced primarily for the purpose of locating the rods while milling collars on them as explained in the preceding installment, but they also facilitate the trepanning operation in that they enable a pilot bar in the center of the trepanning tool to be fed through the rod and into a guide bushing mounted in the machine table.

The trepanning tool consists of a hollow cylindrical shell with two round-nose cutters held vertically, so that a circular groove is cut progressively into the rod as the tool is revolved and fed downward. With a feed of 1/32 inch per second, it takes about thirty-two minutes to cut a solid cylindrical block of steel from one of these rods.

The trepanning tool seen in the illustration is 11 1/2 inches in diameter. Other tools of this type up to 12 3/4 inches in diameter are used. The larger trepanning tools are fitted with three single-point cutters. They are 3/4 inch wide. After a hole has been trepanned through a rod, a finishing cut to a depth of about 1/8 inch is taken with a single-point cutter in the spindle seen on the left-hand head of the machine.

* * *

Tremendous Increase in Gage Manufacture

Owing to the accelerating war production, gages are being manufactured in quantities unheard of in past years. It is said that probably any one of four or five gage-manufacturing companies in the country are today producing more gages than the total production of all gage manufacturers previous to the beginning of hostilities in Europe in 1939.

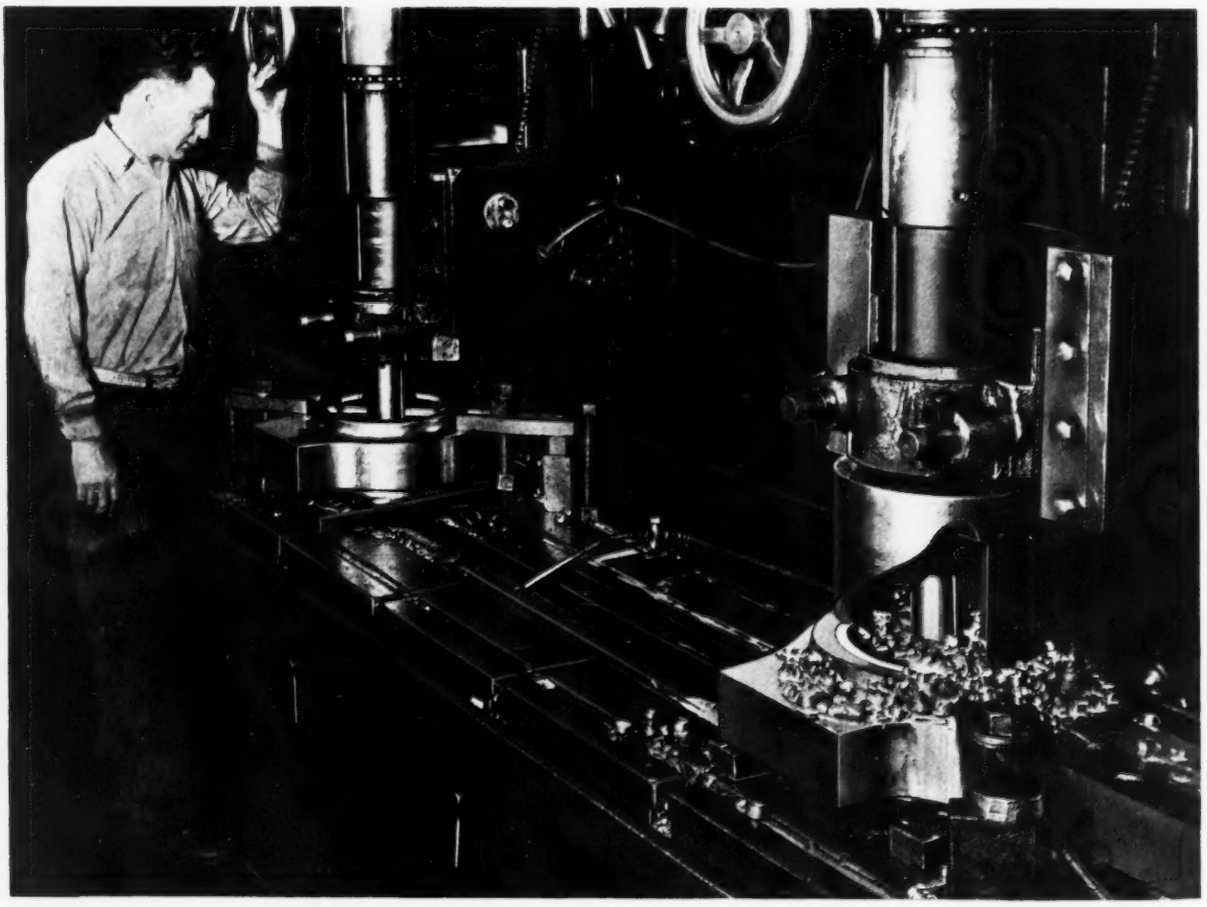


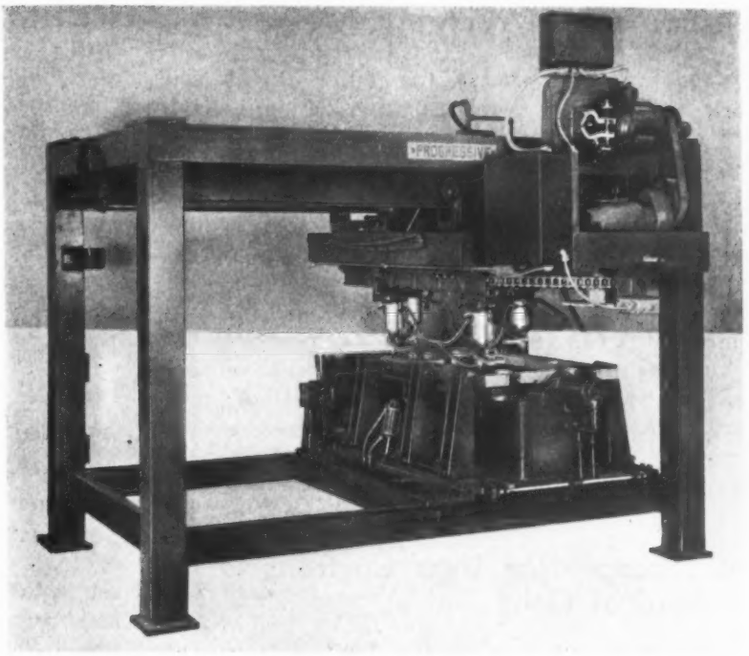
Fig. 11. Trepanning and Finish-boring Holes in the Ends of Side-rods to Receive Crankpin Bushings

A Versatile Welding Machine

The welding machine shown in the accompanying illustration, which is built by the Progressive Welder Co., Detroit, Mich., has some very interesting features. It was developed for welding work that is held stationary in large fixtures while the welding guns move about to the places where welding is required. The machine shown in the illustration was built for welding the back panel to a refrigerator shell. One assembly is welded while another is being loaded and unloaded. The shell and back panel are dropped over the locating fixture, which also contains the lower electrode. The clamping is by air pressure.

In the illustration, one fixture has been removed to show the clamping mechanism at the side of the fixture. When a button is pressed, the entire operating head of the machine moves into position above the loaded fixture; pushing another button starts the automatic welding operation. Four gun points come down and make four welds; at the same time, the chain shown starts to operate, carrying the heads of the welding guns along. The welding time is controlled by an electronic timer. When the welds are completed, the pressure is relieved and the gun points swing, under spring pressure and controlled by the chain, to a new position farther along. Then four more welds are made, and the guns take another step.

To complete one assembly, each gun takes nineteen steps and makes twenty welds 1 1/2 inches apart, or eighty spot welds in all. When one shell is completed and another has been loaded, the operating head moves over above the second fixture and repeats the cycle. The time for the complete welding cycle is approximately twelve seconds.



A Welding Machine in which the Welding Guns Move Automatically to Make Eighty Welds, 1 1/2 Inches Apart, in Twelve Seconds

* * *

As an example of the volume of business now being handled by the corporations in the machine-building field, it may be mentioned that the orders received by the General Electric Co. in 1941 amounted to $1,133,000,000, or 73 per cent more than the previous record of $654,000,000 in 1940. The distribution of the ownership of the larger corporations is also of interest. The General Electric Co. at the end of 1941 had over 218,000 stockholders.

Lead-Silver Solders Save Tin

The use of tin-lead solders will doubtless have to be greatly curtailed, since the tin supplied from the Orient is likely to be greatly reduced or entirely cut off. According to Handy & Harman, 82 Fulton St., New York City, lead-silver solders can be used in place of tin-lead solders. One lead-silver solder contains 2.5 per cent silver and 97.5 per cent lead. It flows at about 580 degrees F. Another alloy contains 2.5 per cent silver, 0.25 per cent copper, and 97.25 per cent lead. This alloy begins to melt at about 580 degrees F. and flows freely at about 660 degrees F. These are relatively soft solders, and should not be confused with the silver brazing alloys and hard silver solders having melting points of from 1175 to 1600 degrees F. It is of interest to note that lead-silver solders containing 2.5 per cent silver cost less than lead-tin solders in which the tin content is 25 per cent or more. This is important, as the much used tin-lead soft solders contain about 50 per cent of tin.

* * *

An index covering OPM and WPB price and priority orders has been made available to business men by the *Journal of Commerce*, 63 Park Row, New York City, and can be obtained without charge by addressing that journal.

Engineering News Flashes

High Speed Achieved by Automatic Carton Machine

The highest award in the machinery classification in the eleventh All-America Package Competition, sponsored by the *Modern Packaging Magazine*, was given to the Miller Cereal Mills, Inc., of Omaha, Neb., for a machine used by this company for making cartons. This automatic carton-making machine, which was built by the J. L. Ferguson Co., Joliet, Ill., receives the cardboard in roll form, cuts, scores, folds, applies adhesive to the lap seam, and seals at a speed of 180 finished cartons per minute. Only one operator is required for the machine. The machine is constructed in the best precision machine manner. Ball and bronze bearings support all rotating shafts, the high-speed helical gears are encased in oil-retaining gear-boxes, and, in general, the equipment makes use of the best machine design practice.

Microscope that Uses Electrons Instead of Light

In a paper read before the American Institute of Electrical Engineers, Dr. David Harker, of the General Electric Research Laboratory, described a new microscope which uses electrons instead of light to form magnified images of minute things. Because electrons are many times smaller than light waves, details that are too small to affect the light waves change the paths of the electrons and produce an image; thus, the magnifying power of the electron microscope is as much as 100,000 diameters, or fifty times that of the most powerful older types. Dr. Harker mentioned that the electron microscope, among other things, permits research workers to find out what happens when metals harden.

Arc Welding Saves 20 Per Cent of Steel in Building Construction

The use of arc welding for fabricating the steel framework in a factory and office building recently constructed for the California Cold-Rolled Steel Corporation, Los Angeles, Calif., helped to save 20 per cent of the steel that would have been required had conventional construction been used.

Two interesting innovations were made in the design and construction of these buildings. First, instead of the usual column construction, the columns of the buildings were made of three I-beams, arranged to form an H-section. The beams forming the flanges were smaller than those forming the central web. The other unusual feature was the employment of alternating-current arc welders for field assembly work. Although it is common practice to use alternating-current welding for shop fabrication, as was done in this case, direct-current welders have ordinarily been used for field welding. On this job, however, General Electric alternating-current welders and shielded arc electrodes were employed. The new factory building is 55 by 250 feet, with sides of sheet steel. It will house a cold-rolling mill for handling narrow strip work.

New Plastic Combines Advantages of Molded and Laminated Types

In a recent statement by Dr. A. A. Bates, manager of the chemical and metallurgical departments of the Westinghouse Research Laboratories, East Pittsburgh, Pa., reference was made to an entirely new type of plastic, which, although still in the experimental stage, promises to combine the advantages of the molded and laminated types. As it gives evidence of being useful in certain materials needed for the war, the research work is being pushed faster than originally planned.

First a mixture of wet pulp and resin is made and formed into the general shape of the finished product. Then the piece is baked under pressure in an oven to harden the resin. The preformed plastic has the strength of the laminated plastic and the moldability of the molded type. Chemists are now working out methods to use this preformed plastic for several purposes, including army requirements.

Small Additions of Silver in Alloys Increase Corrosion Resistance

In a recent report issued by the American Silver Producers' Research Project, 82 Fulton St., New York City, it is stated that alloys containing a small proportion of silver generally show a remarkable resistance to corrosion. For example, 1 per cent of silver, or even less, converts lead into an insoluble anode, suitable for the electrolysis of acid zinc sulphate solutions; inhibits the pitting attack of lead-antimony alloys in sulphuric acid; reduces pitting corrosion of stainless steel; and also reduces the dezincification of brass.

70,000 Tappets Hardened Daily in One Induction Heating Machine

According to information obtained from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., a single automatic induction heating machine used in a large automotive plant now hardens tappets at the rate of 70,000 a ten-hour day—more than 100 a minute. The records show that out of 28,000,000 tappets hardened with this equipment, there have been no rejections due to improper heating.

The tappet is made of cast iron, as in the past, but a steel insert hardened by induction heating and quenching is now brazed to the top of the tappet cylinder. The new design has shortened and stiffened the push-rod considerably, contributing to smooth, silent motor operation and increasing the life of the tappets and rods. Previously, it has not been practicable to harden sufficiently the tappet end required in the new design.

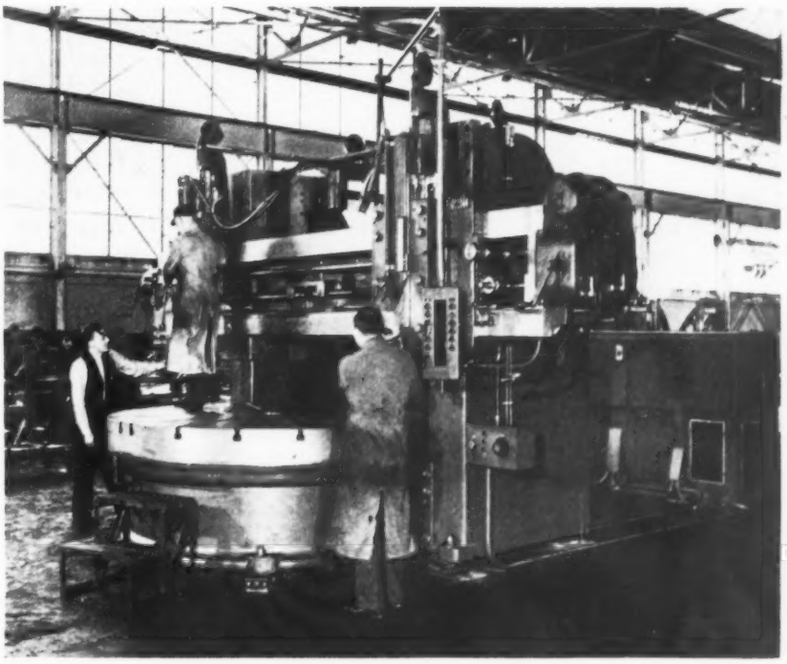
The tappet ends are brazed to the cast-iron cylinder in a brazing furnace by melting a copper wire around the joint. Brazing at the rate of 4000 units per hour is made possible by the conveyor system. The unhardened pieces are then inserted in holes in the rim of a wheel that revolves slowly through a high-frequency field supplied by a 180-K.V.A., 3000-cycle generator. Here the seat and shoulder of the tappet ends are heated to 1500 degrees F. and quenched in about three seconds; the heat is so localized that the other end of the tappet remains at room temperature. The heating process is continuous; each piece is quenched as it drops into the quenching tank below and is carried away on a conveyor.

Air-Conditioning Equipment for the Steel Industry

Air-conditioning equipment is now being installed for blast furnaces. It provides for increased production and more uniform quality of iron by removing water amounting to 30 tons per day from the 2700 tons of air blown through the average-sized blast furnace every twenty-four hours. In this way, the production per blast furnace has been increased as much as 27 per cent. Throughout the country there are twelve blast furnaces already air-conditioned or under contract for air-conditioning, according to J. I. Lyle, president of the Carrier Corporation, Syracuse, N. Y. Three installations have been completed for the Jones & Laughlin Steel Corporation. It is stated that, in this case, production increases of 18 per cent have been made, with coke savings exceeding 5 per cent.

Use of Diesel Engines Increases Fortyfold in Ten Years

According to a statement issued by the Cooper-Bessemer Corporation, the total horsepower of Diesel engines of all types sold in the United States in 1932 was about 100,000. In 1941, Diesel engines were built with a total capacity of 4,250,000 horsepower. In this period, the Diesel locomotive has come into its own. It is said that the Axis nations use Diesel engines in aviation. On the basis of research work now being conducted, it is believed that it is only a question of time before Diesel engines will be used for aviation in this country as well.



A Large Vertical Boring Mill Built by the Fisher Body Corporation. This Company is Manufacturing 100- and 112-inch Boring Mills on Direct Order from the Federal Government to Help Meet the Demand for This Type of Machine Tools, thus Relieving the Load on the Machine Tool Industry. The Corporation is also Building 48- and 72-inch Planers for War-production Purposes

EDITORIAL COMMENT

Machine shop executives who are constantly striving to improve efficiency and reduce operating costs in their plants obviously are interested in equipment of the highest possible efficiency; but in the endeavor to arouse their interest, the enthusiastic promoter of new equipment sometimes goes too far. W. F. Schaphorst calls our attention to an advertisement in a foreign publication that reads: "The Belt Drive which is 100 Per Cent Efficient." Mr. Schaphorst also comments that it is to the credit of both industry and Government in the United States that such statements no longer appear in sales literature in this country, since such exaggerations are restricted by law.

One Hundred Per Cent Efficiency Cannot be Obtained in Practice

"In fact," says he, "even before the days of the Better Business Bureau and the Federal Trade Commission, it is doubtful whether any manufacturer of power transmission equipment in the United States ever claimed an efficiency of 100 per cent. If such a claim has ever appeared in print, it has escaped my notice."

Obviously, a power transmission efficiency of 100 per cent is utterly impossible. Were such an efficiency possible, we would really have introduced the most important element of perpetual motion, since, if there were no transmission or friction losses, a piece of machinery once started, would continue to run forever, if running idle. The closest approach to frictionless equipment probably is the chemist's precision weighing balance, where the knife-edge suspension is as nearly frictionless as anything that has ever been achieved—yet there is some friction even on a knife-edge; and in all power transmission equipment, whether it be belting, bearings, gearing, or chain drives, it is impossible to achieve 100 per cent efficiency, because of friction losses.

According to reliable data, belt drives, properly designed and installed, will transmit power with from 96 to 98 per cent efficiency. Ball bearings reach the highest efficiency of any power-transmitting machine parts, but even ball bearings will not transmit much more than 99 per cent of the power input. The temptation to make exaggerated statements in regard to efficient performance, not only of power-transmitting media, but of equipment of all kinds, is great; but the experienced sales engineer knows that in the long run better sales results are obtained when exaggerated claims are avoided.

We must win the war. All other considerations are secondary; yet there are secondary considerations that are highly important. To give a thought to the transition back to peace work, when the victory has been won and the war ended, is the common-sense thing to do. During the last war, it was possible for industry to accumulate reserves to carry the financial burden incident to the return to normal business and the care of over-expanded plants. But the accumulation of reserves is practically denied industry today by the undistributed profits taxes which force the dissipation of potential reserves.

Reserves for Conversion to Peace Work when War is Won

In the present period of conversion to war work, manufacturers have made expenditures for plant rearrangement and equipment which are recognized as part of the cost of the war. Similarly, in the contraction period, there will be expenditures for plant rearrangement and personnel readjustment. The cost of doing this should come out of present earnings. To provide reserves for what might be called "the conversion to peace work," it is necessary for a company to earn gross profits that may invite criticism. Thus management has the choice of failing to make adequate provision for the contraction when the war ends or being accused of making excessive gross profits.

This difficulty could be avoided easily by an amendment to the Revenue Act permitting, at the present time, the deduction of a reserve covering the estimated cost of restoration to pre-war conditions. These expenses are properly chargeable to the cost of the war effort, and the building up of such a reserve should under no circumstances be considered a "profit"; nor should it be so taxed.

Special Equipment for Airplane Factories

A Description of Machines and Tooling Equipment Especially Designed to Meet the Needs of the Aircraft-Building Industry

By RALPH H. RUUD
Assistant Superintendent
North American Aviation, Inc.

Approved for Publication by the War Department

Testing a Sheet-metal Part with a Portable Pneumatically Operated Hardness Comparator in an Aircraft-building Plant. Material Varying in Thickness from 0.020 to 0.500 Inch can be Handled without Adjusting the Instrument

IN airplane factories there are a large number of operations that have no exact counterpart in other metal-working shops. For such operations, the engineers of the aircraft-building industry are often called upon to develop special machines or tooling. Equipment of this classification, designed to meet the particular needs of North American Aviation, Inc., will be described in this article.

Deep drawing of sheet metal, as usually accomplished under rope type drop-hammers through the use of multiple-stage dies, is being performed in the North American factory on hydraulic presses equipped with a series of simple hydraulic jacks, such as seen in the illustration Fig. 1. These jacks can be arranged in any required number around a die to firmly support a blank-holder or pressure plate against the action of the press ram. In this way, the pressure plate holds the sheet metal being formed tightly against the face of the punch and insures the production of smooth work, formed to the desired contours.

The hydraulic jacks are operated from an oil reserve tank to which compressed air is supplied, so that the oil is forced into the jacks under pneumatic pressure. A pressure relief valve in the line permits the pressure plate to be released momentarily under the action of the press ram, after which the jacks immediately rebuild up to the full pressure, again release, and so on. In this way, even hard metal can be drawn without failure.

In Fig. 2 is shown a long fixture designed to facilitate the contour-sawing of spar cap strips. The fixture is used in conjunction with a standard Greenlee band saw. This operation roughs out the side flanges of the strips to approximately the desired contour, ready for a finish-milling operation. The band saw provides a rapid, efficient method of removing most of the surplus material, and the material removed in this way can be used for making fittings and other parts, thus serving a useful purpose instead of being in the form of chips, which would have no other value than as scrap.

In preparing a spar cap strip for this operation, a reference contour line is first scribed on the face of the flange to be trimmed, and the extruded strip is rigidly clamped to the holding fixture, which is mounted on a roll stand. In

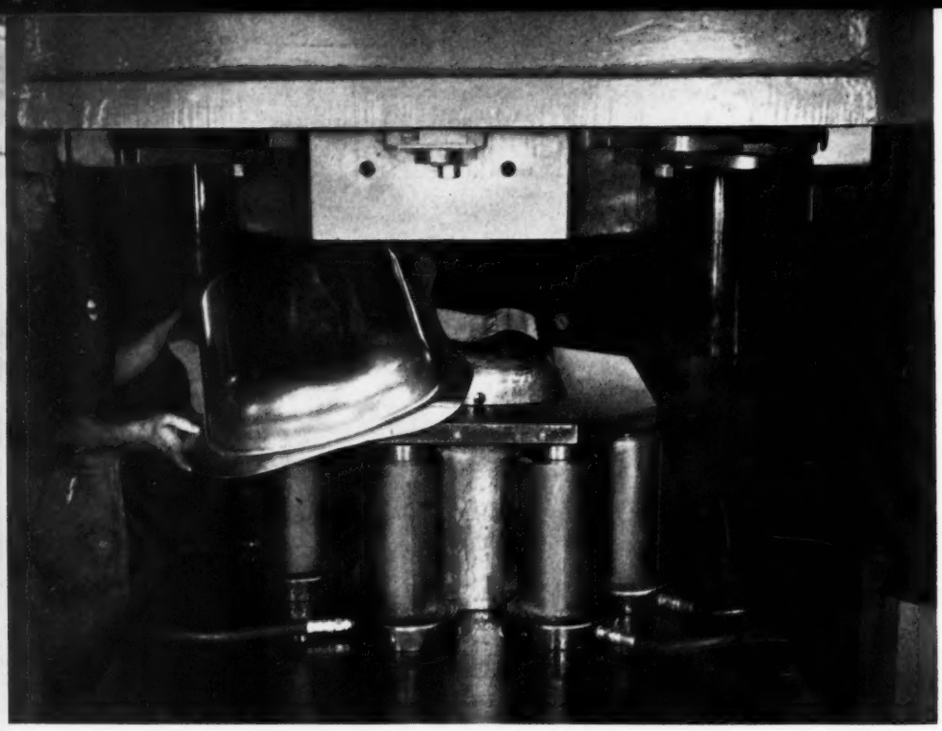


Fig. 1. Hydraulic Jacks, Arranged around a Die for Providing Pressure against a Blank-holder, Facilitate Deep Drawing Operations

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operation, the fixture is pulled past the band saw by an endless cable. During this feeding movement, the fixture is also moved laterally as required, by a guide roll on the saw table following a groove of the desired contour formed by steel strips attached to the fixture base. These guide strips may be seen in the illustration in front of the work-piece. There is also a steering arrangement, with special guide rolls for the saw blade, which enables the operator to correct any tendency of the blade to wander, and thus makes it follow the reference line closely.

The special milling machine shown in Fig. 3 is used for finishing the surface of the spar cap strips that was cut out by the Greenlee sawing machine. This machine is constructed with a main carriage which moves longitudinally on the ways of the bed, carrying the milling cutter along the work, and with a cross carriage which actually supports the cutter-spindle. The cross carriage is mounted on the main carriage on two parallel cylindrical slides. Cross travel of the carriage in conformance with a templet of the desired profile, mounted at the back of the machine, is obtained through a guide roller that is held against the templet by means of an air cylinder.

The longitudinal travel of the main carriage is obtained through a spur gear, driven by a variable-speed motor, which meshes with a rack on the front of the base. The carriage travel is controlled by limit switches at each end of the machine. The cross carriage is provided with a 10-H.P. motor for driving the cutter-spindle. A pump which is attached to the carriage delivers a constant supply of coolant to the milling cutter.

The drilling and milling of engine mounts has been speeded up by the development of the special fixture shown in Fig. 4, which is provided with an electric drill at one end and with a motor-driven milling head at the opposite end. This fixture is pivoted about the center of the engine mount jig, so that it can be indexed to each set of lugs to be drilled and milled. The fixture is locked in the indexed positions by a hardened pin that engages bushings in the jig.

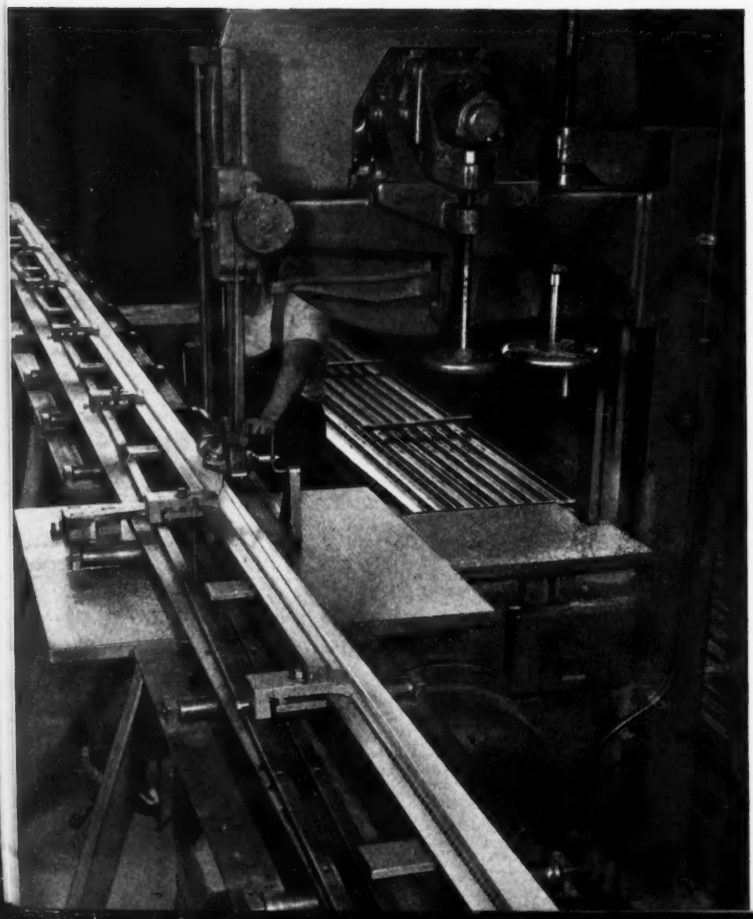

Fig. 2. Long Roller Type Fixture Designed for Feeding Spar Cap Strips Longitudinally and Laterally in Sawing Them to Required Irregular Outlines

Fig. 3. Special Milling Machine Designed for Finishing the Edges of the Spar Cap Strips that are Sawed by the Machine Shown in Fig. 2

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The holes are accurately drilled in the lugs by using the long drill, which is guided through hardened bushings. The electric drill is then employed for spot-facing and back spot-facing the lugs. While these operations are in process, the milling head on the opposite side of the fixture is employed for gap-milling the inner faces of the lugs within close limits.

Fast milling of small parts of irregular contour on a standard type milling machine has been made possible by equipping the machine shown in Fig. 5, with an Eklund hydraulically actuated arm that carries a tracer on one end and is attached to the milling spindle at the other end. As the tracer is guided over the irregular surfaces of a master mounted on the table at the left, it imparts similar movements to the milling cutter. Spring-loaded stops automatically reverse the table movement at each end of its travel.

Motor-driven rolls developed for flattening out burrs formed in blanking and drilling operations on sheet metal are illustrated in Fig. 6. When the blanked or drilled sheets are fed through the rolls, the burrs are simply depressed back into the holes, a procedure that is entirely practical because the holes are later enlarged during assembly of the sheets. With the usual laborious hand-burring methods, a sheet such as the one shown, would require approximately one hour for removal of the burrs. This sheet is burred by the motor-driven rolls in less than one minute.

The rolls are quickly adjustable to suit the thickness of the sheets to be handled. Oil-impregnated felt wiping pads are provided at the front of the rolls to keep them free from drill chips, dirt, etc., and to maintain a protective film of oil on the rolls.

Greatly increased visibility of the work and automatic operation are features of the radial-arm drilling machine shown in Fig. 10, which is driven by a 3/4-H.P. high-cycle motor running at 15,800 R.P.M. This machine is equipped with a Logan Air-draulic cylinder for feeding the drill through the work, and also for imparting a rapid return. The operation of this cylinder is controlled by a valve under the right-

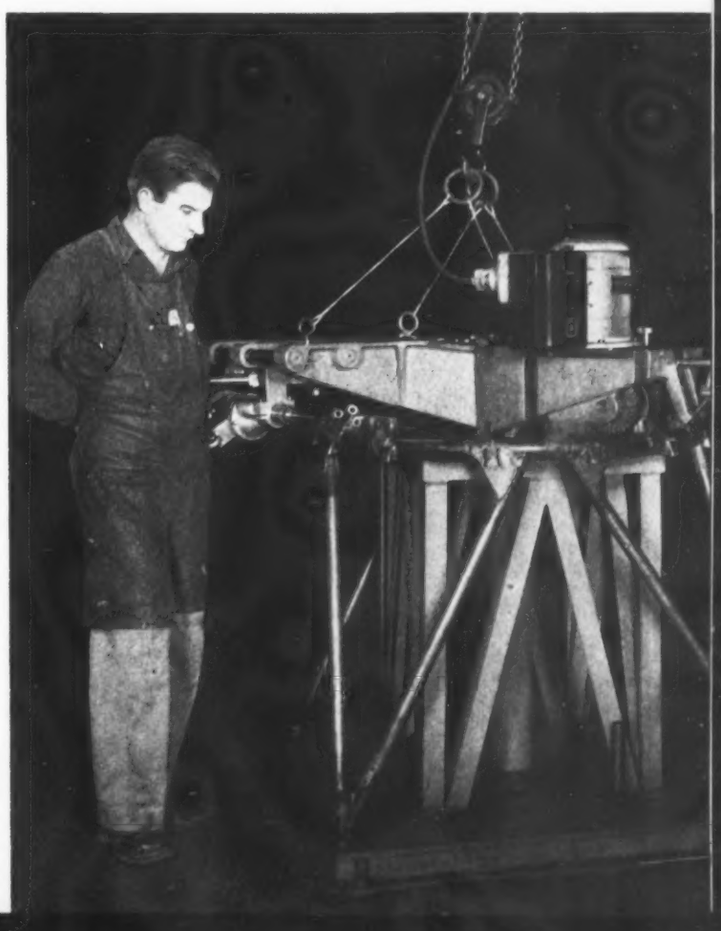

Fig. 4. Fixture that Takes Drilling, Spot-facing, and Back Spot-facing Cuts with the Electric Drill at Left, and Milling Cuts with the Motor-driven Head at Right

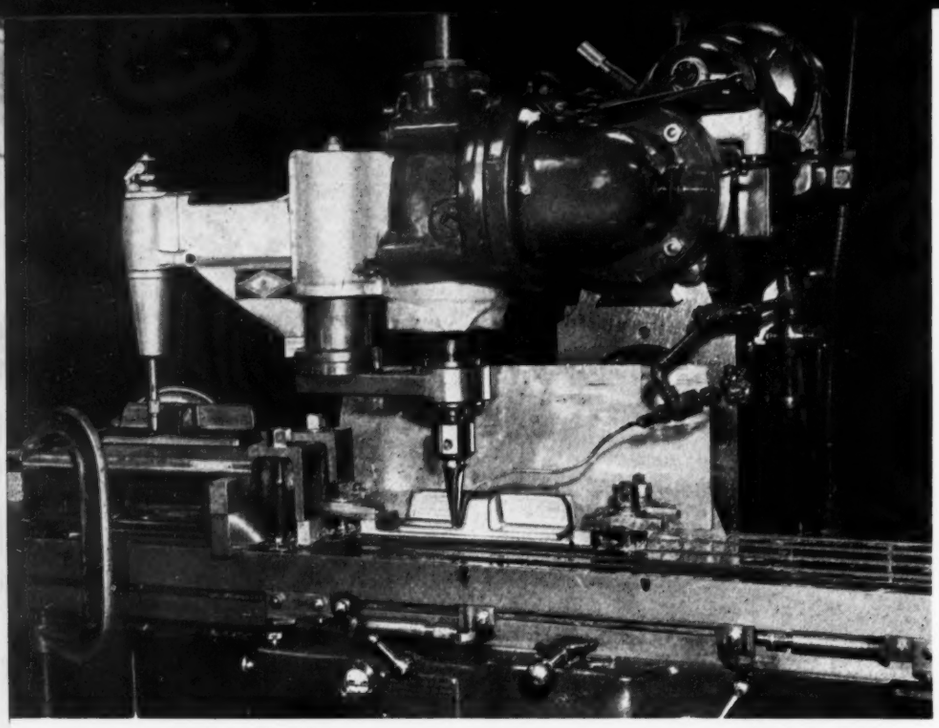

Fig. 5. Milling Machine Equipped with Hydraulic Arm by Means of which Movements of a Tracer at the Left as it Passes over a Master are Imparted to the Cutter

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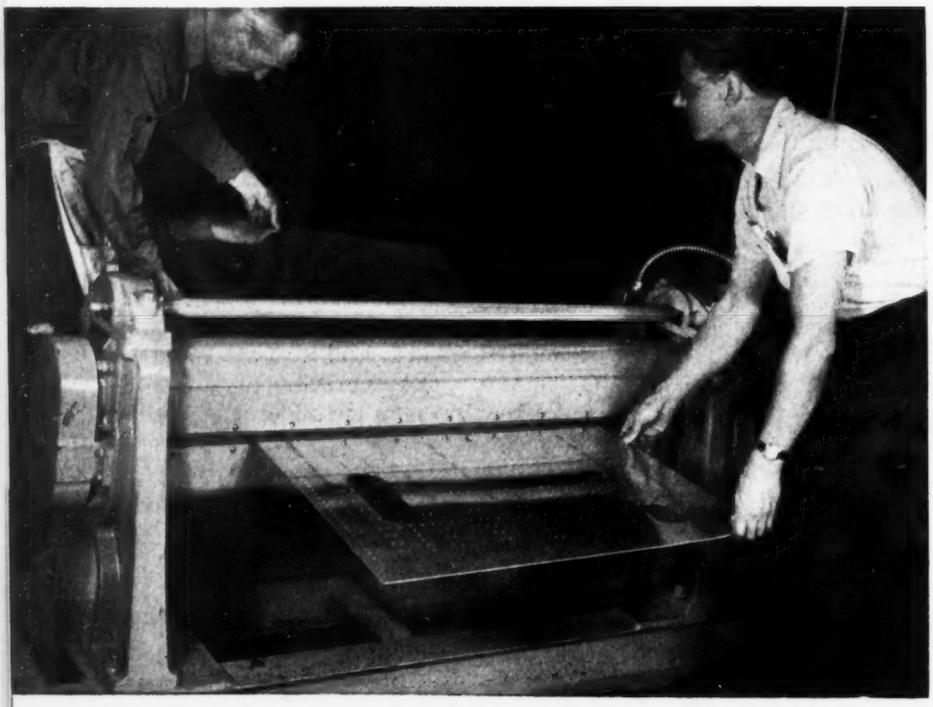

Fig. 6. Motor-driven Rolls Developed for Flattening down the Burrs Formed in Blanking and Drilling Operations

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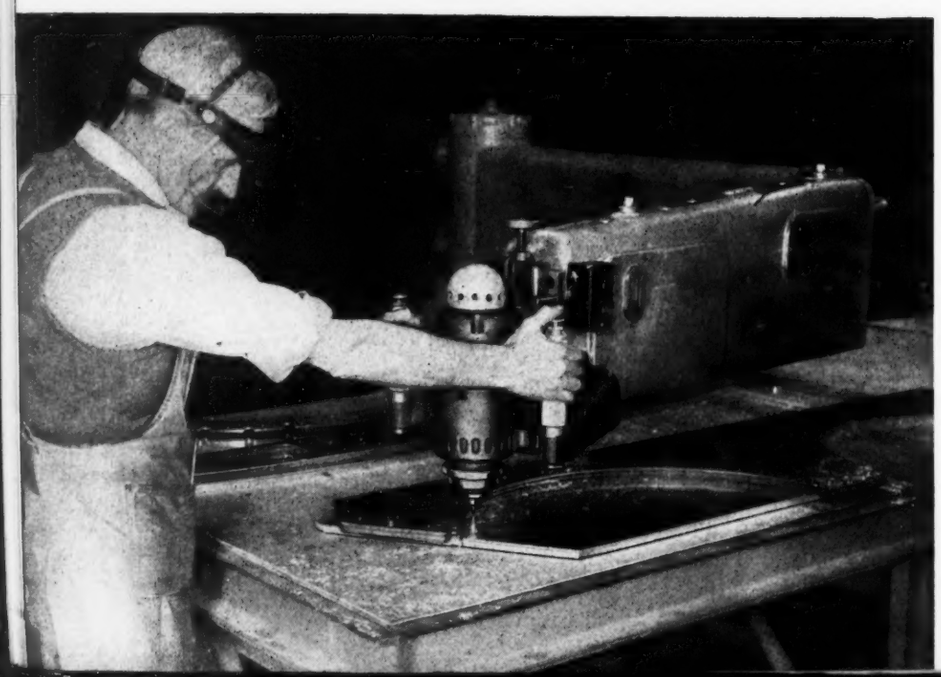

Fig. 7. Radial-arm Router of Similar Design to the Drilling Equipment Shown in Fig. 8, which has a Speed 300 Per Cent Greater than the Equipment Previously Used

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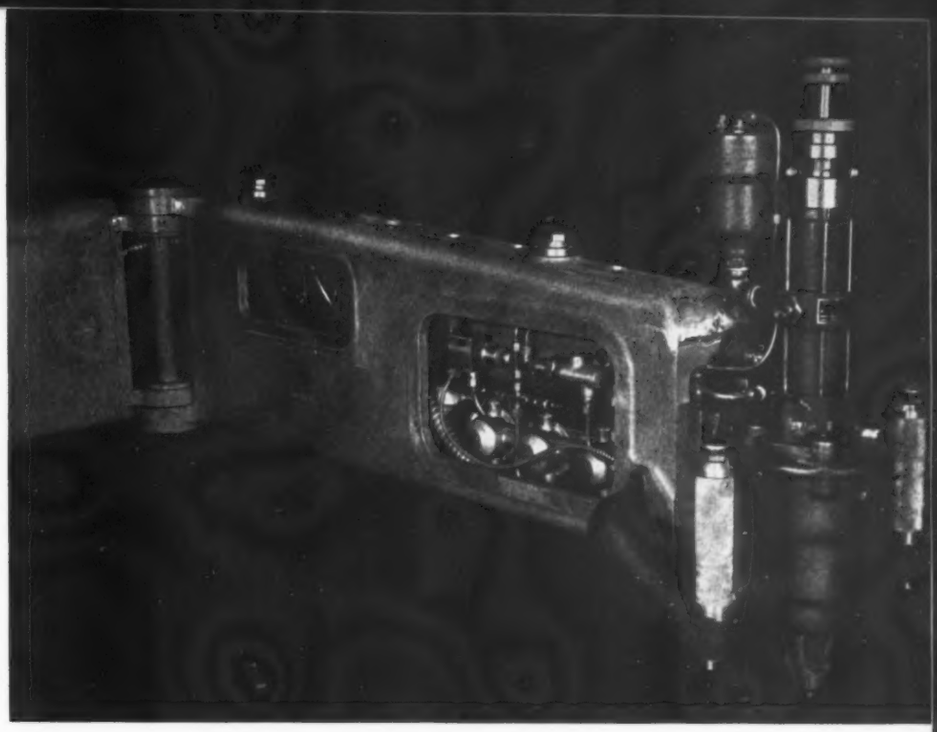

Fig. 8. View of Radial-arm Drilling Machine Seen in Fig. 10, with the Covers Removed to Show the Method of Installing Pneumatic, Electric, and Lubricating Connections

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hand thumb of the operator, which admits air into a chamber surrounding the motor and causes a pressure of 100 pounds per square inch to be exerted on a hold-down foot. A valve under the operator's left-hand thumb also controls the admission of air to the same chamber, providing a slight preload of air, which causes the hold-down bushing to maintain a light pressure on the work. This enables the drill spindle to be easily indexed from hole to hole in the templets as required for drilling the rivet holes in the sheets.

A mixture of oil and air is supplied to the point of the drill, both for lubricating the drill and keeping the surface of the work free from chips. A solenoid valve is incorporated in the unit for controlling this mixture, so that it is delivered only when the machine is in actual operation. Quickly detachable electric, air, and oil connections are used for easy maintenance, and all tanks, control valves, and supply lines are concealed within the arm, as shown in Fig. 8, to provide a neat appearance.

The base and arm assembly of the radial-arm drilling machine has also been adopted for an improved radial-arm routing machine, as can be seen from Fig. 7. This machine is equipped with a high-torque, high-cycle motor instead of the air turbine motor previously used, with the result that the cutting speed has been increased approximately 300 per cent. Other refinements have been incorporated in the design, including a new control system, by means of which the cutter can be fed down into the work at any speed and stopped at the desired depth or returned to the clear position.

This vertical movement is controlled through two valves on the hand grips which actuate a master control valve that governs the admission of air to the pneumatic cylinder in the head of the machine. An additional manual height adjustment is provided at the post on which the

Fig. 9. Duplex Type of Press Equipped with Pneumatic Cylinders for Holding Down the Upper Half of the Hard Plaster Molds Used in Forming Plexiglas

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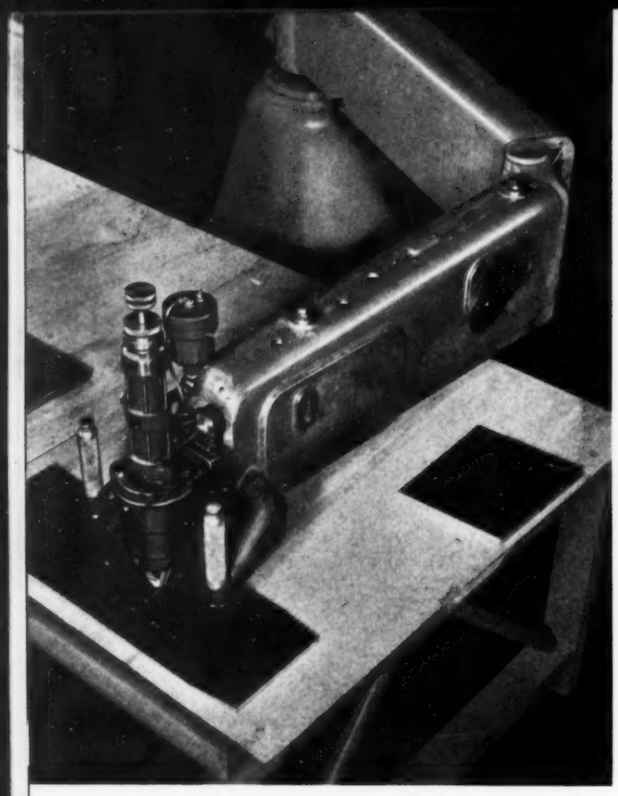

Fig. 10. Radial-arm Drilling Machine which is Completely Operated through Thumb-buttons on the Handles, which are Gripped by the Operator

Fig. 11. Waffle Type of Drill Jig that has Enabled Substantial Reductions to be Made in the Tool Costs for Drilling Small Sheet-metal Pieces

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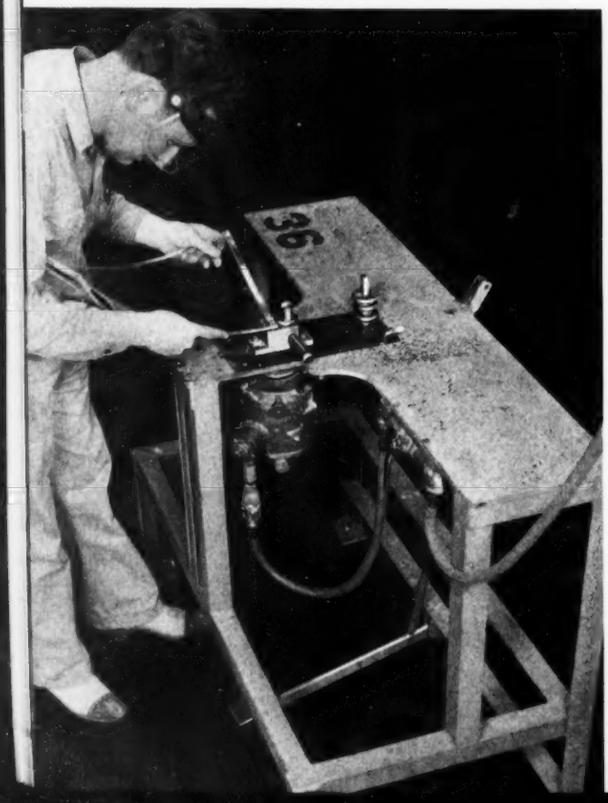
Fig. 12. Simple Machine Devised for Grooving or Recessing the Edges of Plexiglas Enclosure Panels to Fit Retaining Strips



radial arm is hinged for jobs that require an adjustment beyond the range available through the automatic slide on which the head is mounted.

An oiling system has been provided for the motor, which operates automatically when the motor is turned on. As the cutter is fed down into the work, a second oiling system goes into operation, furnishing the cutter with an air and oil mixture, the same as on the drilling equipment, both for providing coolant and blowing away chips.

A duplex pneumatic press for the forming of Plexiglas, by means of which continuous production is obtained, is shown in Fig. 9. This press was designed to replace the weight system of forming this material. The sheet to be formed is cut out roughly to shape, preheated to a pliable condition, and then pressed to the proper form between hard plaster molds covered with flannel. The upper mold on each side of the machine is attached to the piston-rod of an overhead air cylinder, and is pressed firmly on the work when air is admitted to the cylinder on the top side of the piston. At the end of the operation, air is admitted to the cylinder on the bottom side of the piston to return the upper mold to the position illustrated. One side of the machine is reloaded while a part under pressure on the opposite side of the press is cooling sufficiently to maintain its shape when removed from the molds.

The machine illustrated in Fig. 12 was developed for accurately grooving or recessing the edges of Plexiglas panels, so that the retaining strips used in fastening them to bombardier and gunner enclosures will be flush with the external contours of the plane.

This machine consists simply of a cutter-spindle driven at 22,000 R.P.M. by a 2 1/2-H.P. air turbine motor. A small cutter mounted on the upper end of the spindle removes the Plexiglas stock to the prescribed width and depth as the material is fed past the cutter, with the operator holding the material on a small block.

Appreciable reductions in tool costs of drilling operations on small sheared and blanked parts have been effected by the use of waffle type drill-plate holders, such as seen in Fig. 11. The holder consists simply of two aluminum castings, hinged on a length of drill rod. The drill plate is inexpensively made from cold-rolled steel, 1/4 inch thick, provided with the necessary guide bushings and work locating pins. The drill plate is attached to the top half of the holder by means of four studs. It can be mounted or removed in less than three minutes. A quickly replaceable block of Masonite is fastened in the bottom half of the holder to receive the end of the drill as it passes through the part being drilled.

A portable pneumatic hardness comparator, designed to enable the inspection department to test the hardness of materials rapidly, is shown in the heading illustration. A hardened steel cone is pushed into the metal surface being inspected by compressed air. The dial is calibrated for soft, medium, and hard materials by clearly defined limits, so that all inspectors work to the same acceptance standards.

Material varying in thickness from 0.020 to 0.500 inch can be handled without adjustments on the comparator. To facilitate the inspection of small parts, the comparator may be set up on a stand and operated by a foot control. When the parts to be tested are too large and awkward to bring to such a machine, the comparator is applied directly to the work, as shown.

"Human Conversion" to War Work

CONVERSION to war work does not consist only in moving shop equipment around and changing tooling, jigs, and fixtures to adapt them for new jobs. Taking men from one occupation and introducing them to an entirely different kind of work is also a conversion problem. There are today literally thousands of automobile dealers, salesmen, jewelers, teachers, and people from many other occupations who are enlisting in a new army of craftsmen that will turn out tanks and planes and guns.

One organization that has devoted its attention particularly to this human conversion problem is the N. A. Woodworth Co., Ferndale, Mich. In one of the company's plants, for example, a jeweler is performing important inspection work on engine parts of high precision. Obviously, his experience in handling and examining watches and delicate jewelry soon fitted him for this production operation.

Another case is that of a restaurant cook who was merely transferred, so to speak, from a small oven to a much larger one. Being used to working comfortably in a warm atmosphere in the kitchen, and understanding the value of heat control, he fitted in nicely in the heat-treating department. Today he is a good tool-hardener, in spite of the fact that, measured in days and weeks, his experience has been comparatively brief.

A sales manager of a used car department of a Michigan firm, during his work in appraising cars and supervising repair work, developed a familiarity with engine parts. His experience is valuable to him now in making various shop tests on airplane parts. These are but a few examples indicating how people from all walks of life are now filling a place in the munitions manufacturing program.

* * *

Importance of Using Large Electrodes

E. W. P. Smith, consulting engineer of the Lincoln Electric Co., Cleveland, Ohio, recently completed a survey of welding throughout the war industries. According to Mr. Smith, 75 per cent of the arc-welding work done today could utilize at least one size larger electrode. A great saving in the time of welding operators could be made if larger electrodes were used, because they have a faster rate of deposition and, therefore, permit welding a given length of seam in a shorter time. In addition to the use of larger electrodes, welding can be accelerated by employing high-capacity welding machines, using jigs and fixtures for locating and holding the work, and proper "fit-up" of parts. "Properly locating and holding the parts," Mr. Smith says, "will speed up work from 25 to 50 per cent."

* * *

Wars are not won by speeches, nor by a multitude of rules covering minute, comparatively unimportant details. Wars are won by positive, constructive ideas, translated into work and action; and work and action can be directed only by those who have proved themselves capable of achieving production results in the past.

Selecting Oven Type Heat-Treating Furnaces

Characteristic Features of Gas and Electric Oven Type Furnaces Used for Heat-Treating Tool Steels and for Various Other Heat-Treating Operations—First of a Series of Four Articles

By HOLBROOK L. HORTON

IN the shop or plant requiring limited heat-treating facilities, one of the pieces of equipment most commonly used is a small oven type furnace. Such a furnace is quite versatile in its application, and often can be utilized over a wide temperature range for annealing, preheating, hardening, and tempering operations on various tools and small parts. A large number of furnaces of this type are now being manufactured, many of more or less standard design, and some having special constructional features or auxiliary equipment to perform specific functions. There is, therefore, a wide selection to choose from.

Because of the many uses for which the oven type furnace is applicable, however, its selection should be made with due consideration to the different heat-treating duties it is to perform. In this article, various heat-treating furnaces of the oven type, mostly of the smaller sizes, will be described. The principal features of design, construction, and operation will be discussed and characteristics noted. In making the final selection, however, representatives of the individual manufacturers should be consulted.

Small oven type furnaces can be broadly classified into two groups: Those heated by gas and those heated by electricity. Oil-fired heat-treating oven furnaces are also manufactured, but the first two types are by far the most widely used in small installations. Both the gas-fired and the electric types of oven furnace have desirable characteristics and advantages. Special plant conditions or operational requirements may well justify a leaning toward electric or gas operation. Ordinarily, however, it is good policy to give each piece of equipment considered a chance to measure up to the various specific requirements established before judgment is passed on any single feature.

Small Johnson Gas Appliance Co.'s Bench Type Gas Oven Furnace for Heat-treating High-speed Steels

Some of the points that should be considered in selecting a small oven type furnace are: Whether it would be more conveniently located on a bench (bench type) or on the floor (pedestal or stand type); whether a high maximum temperature (hardening of high-speed tools) or a low temperature range (annealing, tempering, etc.), or both, are required; whether the maximum temperature must be reached quickly when heated from cold (intermittent operation) or whether ample time is usually available for this initial operation; the size of the hearth and the height of the heating chamber (the hearth should roughly be three times as wide and twice as long as the largest piece to be hardened); the kind of closure required (whether foot- or hand-operated, automatic closing, etc.); and the accessibility of various parts for repair or replacement (permanent location of the furnace in close proximity to other equipment or building walls may be a deciding factor here). If a gas furnace is to be used, consideration must be given to the number and location of the burners; the kind, pressure, and B.T.U. content of gas available; and whether a high- or low-pressure air supply is to be used. If the furnace is to be of the electric type, the location of the heating elements, the voltage preferred, and the means of control must be considered.

Types of Gas-Fired Oven Furnaces

Gas-fired oven furnaces are available with three general types of heating chambers: The full-muffle type, the semi-muffle type, and the

direct heat type. The first has a separate chamber in which the tools or parts are placed for heating. As the flames and burning gases cannot come in contact with the work, protection is afforded against oxidizing and scale formation. Some form of atmosphere control is commonly used with this type.

In the semi-muffle type, the muffle is open at the top so that the work is surrounded by burning gases, although protected against direct impingement of the flame. This type affords the advantage of quicker heating than the full-muffle type, but some scaling and decarburization may be experienced unless close control of the combustion mixture is maintained.

In the direct heat type, the combustion takes place in the main furnace chamber, and the material being heated is bathed in flame. This may be the least expensive of the three types of furnaces from the standpoint of initial cost, but against this must be balanced not only an even greater likelihood of scaling and decarburization than is likely to occur in the semi-muffle type, but also the possible difficulty of maintaining an even heat. All three types have applications for which they are best suited, and care should be taken to weigh their advantages and disadvantages in the light of each specific installation.

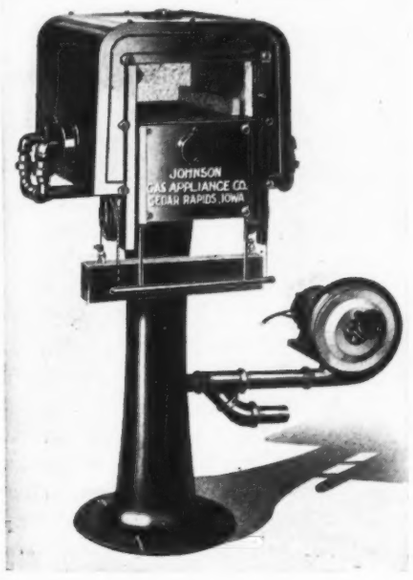
Small, Low-Temperature Gas Oven Furnaces

A small oven furnace designed particularly for tool-room use has a welded sheet-steel and angle-iron casing with cast front and back plates. The furnace proper is mounted on an angle-iron supporting frame for floor installation. A special type of insulating refractory lining is employed which weighs about half as much as fireclay lining designed for refractoriness only and which has six times as much heat-insulation value. A self-sealing door mechanism and observation window in the door are provided. Quick replacement of hearth slab or check-up on the condition of the combustion chamber or burners is facilitated by a removable back plate and back brick.

One-valve gas and air control regulates the input over the entire operating range with an adjustment variation of 6 to 1. Although regularly supplied for operation in the 1500-degree F. range, the construction of this furnace is such as to permit satisfactory operation at temperatures of from 1200 to 1800 degrees F. The customary design operates on gas at line pressure and air at one pound per square inch, but other designs are available that operate effectively on air pressures down to one-half pound per square inch or on regular compressed air systems.

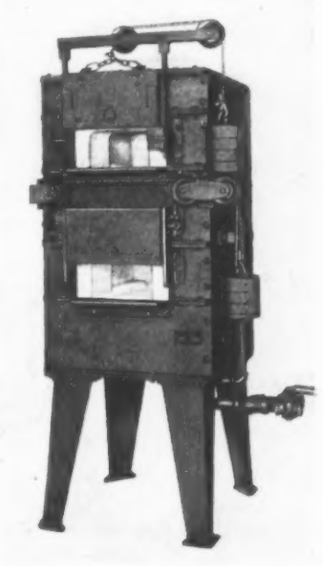
When needed, intermittent- or continuous-duty blowers are supplied as auxiliary equipment. For duplication of previous settings, a dial type manifold pressure gage is available. The door opening is 8 inches wide by 4 inches high, and the hearth is 14 inches long. A 45-minute period is required to heat from cold to 1500 degrees F. Maximum input is about 66,000 B.T.U. per hour.

Another similar type of furnace has a body formed of two heavy cast-iron plates connected to an arched steel casing, and is supported on a heavy cast-iron base and legs. The door is counterbalanced, and has a small opening with slide cover for viewing the furnace interior. A pyrometer opening is provided in the rear wall. The interior lining is of first-grade firebrick, constructed in easily replaceable sectional shapes.



(Left) Pedestal Type Gas Oven Furnace Built by Johnson Gas Appliance Co. for High-speed Steel Heat-treating

(Right) Bellevue Industrial Double-deck Gas Oven Furnace. Upper Chamber is Used for Preheating, while Lower Chamber is Used for Heat-treating High-speed Steel



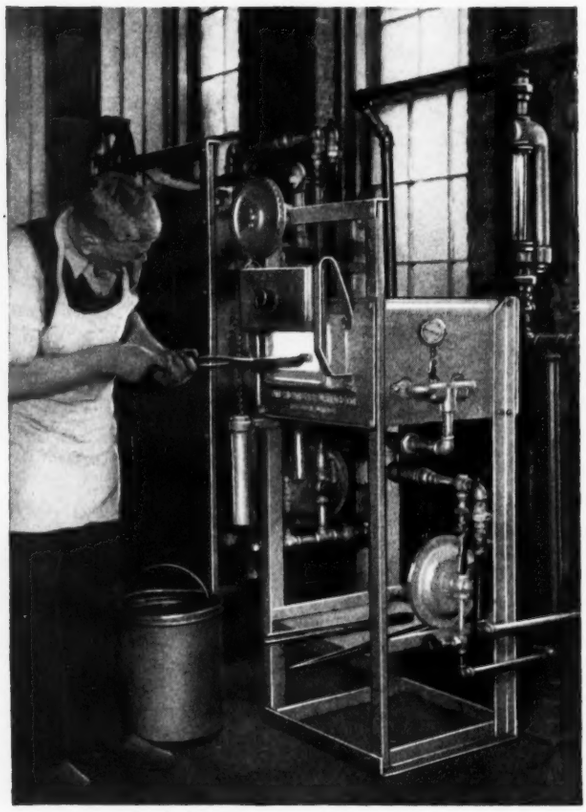
A removable tapered refractory plug and back plate permit replacement of the U-shaped hearth. Additional insulation is provided by low heat-loss material between the inner firebrick lining and the outer frame. The U-shaped hearth slab has side walls which are high enough to prevent the work from being pushed off into the combustion zone. Four burners firing under the hearth heat the work by convection and radiation. The door opening is 4 inches high by 8 inches wide, and the heating chamber is 12 inches long. This furnace can also be secured for bench use, in which case it is mounted on legs 6 inches high.

A somewhat larger furnace of similar type, has a hearth that can be removed through the door at the front. This permits permanent location of the furnace close to a wall. Firing is by means of four burners, and is from each side under the hearth. The flames do not touch the work, but hot gases are distributed in an even blast to the sides and top of the heating chamber, furnishing a positive, uniform heat. The door opening is 5 inches high by 9 inches wide, and the heating chamber is 14 inches long.

Suitable for forging, brazing, and rivet-heating, as well as annealing or tempering, is a small combination forge and oven furnace, which is pedestal-mounted. This furnace is open at both ends, but can be closed with blocks or tiles which rest on supporting shelves, when greater heat concentration is desired. Firing is both below the hearth and at the top of the arch.

Another small oven furnace with a maximum operating temperature of 2000 degrees F. is made of heavy steel plate and structural steel casing, welded throughout. The lining is of 3-inch thick first grade fireclay tile with an additional 1 1/4 inches of insulation. Automatic proportioning one-valve control burner equipment is provided with tunnel type burners firing under the hearth from both sides of the furnace.

With low-pressure equipment, the minimum operating temperature is 1000 degrees F., and with high-pressure equipment, it is 1200 degrees F. In the smallest size, the door opening is 9 inches wide by 6 inches high, and the hearth is 14 inches long. In the largest size, the door opening is 15 inches wide by 8 inches high, and the hearth is 27 inches long. The smallest size has a maximum input of 140,000 B.T.U. per hour, and the largest size a maximum input of 261,000 B.T.U. per hour.



Tool-room Gas Oven Furnace for Heat-treating Operations up to 1800 Degrees F., Built by the American Gas Furnace Co. A One-valve Input Control is Provided

Gas Furnaces for Heat-Treating High-Speed Steels

For heat-treating small high-speed tools, including cutters, reamers, etc., a small oven furnace provides either an oxidizing or a reducing atmosphere and a temperature range up to 2400 degrees F. The furnace lining is a molded, hard-burned refractory; the counterbalanced door is of hard-burned firebrick, and has a built-in observation window. The door opening is 5 inches high by 5 inches wide, and the hearth slab is 10 inches long. The maximum input is 170,625 B.T.U. per hour.

Designed primarily for heating high-speed steels is a small furnace of the bench type equipped with a motor-driven blower, which reaches a temperature of 2450 degrees F. in thirty minutes from cold. It can also be furnished with special valves to operate at temperatures as low as 1000 degrees F. A 6- by 9-inch Carborundum hearth is standard equipment, and the burners are located below the hearth. The firebox, which is 5 inches high, is heavily lined with insulating refractory. A Pyrex peephole is provided in the door for observation of the furnace interior during operation. Maximum input is 70,000 B.T.U. per hour.

There is a similar design of furnace especially suited to the economical hardening of punches, dies, and tools. This model is pedestal-mounted. It has a 6- by 13 1/2-inch Carborundum hearth and a firebox 5 inches high. This furnace reaches 1500 degrees F. in five minutes, and develops 2300 degrees F. in thirty minutes from a cold

start. Low-temperature valves can also be furnished. Maximum input is 120,000 B.T.U. per hour.

A somewhat larger design of pedestal furnace has an 11- by 13 1/2-inch Carborundum hearth and a 5 1/2-inch firebox. This furnace has consistently developed under test a temperature of 2300 degrees F. in twenty-two minutes from a cold start. Maximum input is 250,000 B.T.U. per hour.

Departing from conventional design in some particulars is a high-speed steel furnace in which the burners fire immediately under the arch. This is completely sealed, and the products of combustion are forced through vents located beneath the hearth slab. Since the hot products of combustion cannot escape through the top, a positive pressure is built up within the furnace chamber, which precludes infiltration of outside air, even when the door is not tightly closed. With this arrangement, the entire furnace becomes, in effect, a muffle in which the desired atmospheric conditions can be maintained.

A single valve controls the mixture of gases admitted, and functions to hold the ratio of air to gas constant over the entire operating range, with a turndown of 6 to 1. The proportion of gas to air can be adjusted at any time by means of the ratio cock to give any desired combustion condition. The burners have heat-resisting alloy tips which do not oxidize, corrode, or "grow," and they fire into specially molded, hard-burned Sillimanite burner tunnels. Auxiliary atmosphere adjusting burners are provided, which are regulated to burn any small percentage of unburned air remaining after the heating burners are set for their most efficient operation.

The furnace lining is made up of 2 1/2 inches of Sillimanite, 2 1/2 inches of insulating refractory, and 2 inches of block insulation. Because of the heat storage provided by this lining, an undue drop in furnace temperature is avoided when work is placed in the heating chamber. The Sillimanite hearth is 12 by 14 inches, and the door opening 12 inches wide and 5 inches high. The furnace is designed to operate in a temperature range of from 2100 to 2500 degrees F., and will reach 2400 degrees F. in two hours. Maximum input is about 158,000 B.T.U. per hour.

A special design of furnace for high-speed steel heat-treating has a double deck arrangement. The upper oven is heated by waste gases from the lower high-heat chamber, and is used for preheating. The lower oven is designed for regular high-speed steel heat-treating work. In the smallest size, both door openings are 4 inches wide by 6 inches high, and the ovens are 12 inches long. In the largest size, the door openings are 18 inches wide by 12 inches high, and the ovens 36 inches long. Other combination units available are a combination preheating oven, cyanide furnace, and small babbitt pot, and a combination high-speed steel furnace, cyanide hardening furnace, and preheating oven.

* * *

Cleaning of Metals in the War Production Industries

Three war production conferences on cleaning and related manufacturing operations were held by Oakite Products, Inc., 22 Thames St., New York City, during the month of April in New York, Chicago, and Los Angeles. There was a three-day program in each city, with sessions devoted to discussions of improved ways to speed up production in connection with the manufacture of airplanes and airplane engines, shells, cartridge cases, guns, tanks, bombs, etc.

Among the specific topics covered were new materials for cleaning parts by tank and automatic washing machine methods before inspection, assembly, and finishing operations; new methods for preparing aluminum alloy aircraft parts, structures, and assemblies for resistance spot welding and anodizing; removing quenching and tempering oils from heat-treated rifle, machine-gun, and small cannon parts; and cleaning polished steel, buffed brass, zinc, and other metals and alloys. Such related production operations as cutting, grinding, drawing, and stamping were also discussed. Each conference also reviewed various other types of essential cleaning from production, maintenance, and sanitation standpoints.

* * *

Can Inflation be Prevented by Taxation?

We now hear suggestions that the tax rates should be increased to prevent inflation, on the theory, not that increased taxation means less government borrowing and, therefore, less inflation, but that if we take away the people's money through taxation, they won't have it to spend, and, therefore, can't bring about inflation. But inflation never resulted from spending what we have; it results from spending what we do not have—in other words, from creating credit money. To say that we should impose severe taxes so that people cannot have money to spend for things they would like to buy is to say we should cut off an arm to avoid a possible finger infection.

To top it all, if we succeed in preventing people from spending money, what will produce the income out of which we may obtain the billions of dollars of income tax revenue we require?—*Walter A. Cooper in "A Sound Basis for Taxation"*

Suggestions on the Design of Threaded Parts

THE die-head manufacturers of the country have published a leaflet entitled "A Few Important Suggestions on the Design of Threaded Parts," pointing out how, through the observation of a few simple rules, there could be a considerable speeding up of war production. The leaflet is obtainable from any manufacturer of die-heads.

To quote from the leaflet: "We find that drawings or specifications for an increasingly large proportion of screws and threaded parts specify a full thread closer to the shoulder than is practical, without giving proper consideration to the manufacturing difficulties of carrying out such specifications."

The difficulties of threading close to a shoulder are especially emphasized. Threading close to a shoulder requires die chasers with short chamfers or throats. Chasers with short chamfers are special in the trade. They are not kept in stock, and are more expensive. Accurate threads are more difficult to produce with short-chamfer chasers.

The finish of the thread is not so good when cut with short-chamfer chasers. This is especially true on stainless steel, chromium-nickel steel, and many other alloy steels used in defense parts. When full threads are required very close to a shoulder, it is often necessary to rethread, thus adding to the cost and slowing up production. Hitting the shoulder when trying to cut close to the shoulder is the chief cause of chaser breakage, and this means "down time" and the waste of an important tool.

Chasers with short chamfers or throats have a greater tendency to chip or break when cutting. They also have a much shorter life per grind and require slower cutting speeds. When short-chamfer chasers are used, less production is obtained, not alone from the slower cutting speeds, but also because of the "down time" required for changing chasers frequently. Also, more scrap results, due to poor finish.

The following definite recommendations are made: Whenever possible, do not specify full threads closer to the shoulder than 2 1/2 or, preferably, 3 threads. Make it possible to use chasers with chamfers at least 2 1/2 threads long for efficient cutting. The longer the chamfer or throat, the better the distribution of chips. This means better finish on the work and longer chaser life.

When screws must be screwed into tapped holes close to the head, the screw should be necked or recessed. The neck will not materially weaken the screw, because the bottom is only slightly below the root diameter of the thread. A bevel of 30 degrees on the thread side of the neck is recommended.

Another way to avoid threading close to a shoulder is to counterbore or, at least, countersink the tapped hole, or use washers. When screws requiring full threads close to a shoulder are in production, the design can be changed to provide a neck or recess, or a wider neck, if there is a narrow one, without interfering with the interchangeability of the parts.

Designers are also requested to use standard threads whenever possible—and it is almost always possible. War production is greatly held back by the fact that special thread sizes are specified in hundreds of instances. Such special thread sizes require, in addition to special chasers, special taps and gages. This not only means extra expense, but frequently many weeks and even months are lost in getting into production; and what we need at the moment in war production is speed.

Thread sizes should always be selected from the National Bureau of Standards Handbook H-28, 1942 (Screw Thread Standards for Federal Services). Standardized threads, and standardized tools in general, help to speed up the production of war materials. Naval and ordnance designers themselves, are in many cases guilty of specifying special threads, even though screw thread standards for the Federal services are available. Many instances are on record where manufacturers have asked that, in the interest of speed of war production, standard threads be substituted for the special threads specified, and the Army and Navy authorities have refused to make such changes.

* * *

Summer Meeting of Automotive Engineers

The annual summer meeting of the Society of Automotive Engineers will be held at the Greenbrier Hotel, White Sulphur Springs, W. Va., May 31 to June 5. Because of the nature of the papers to be presented, none but American citizens and citizens of the Allied nations will be permitted to register and attend the sessions. The meeting will extend over five days, with morning, afternoon, and evening sessions. Nearly fifty technical committee meetings will also be arranged for. Design and manufacturing problems involved in producing armament will occupy the majority of the sessions. Officers of the Army, Navy, and Air Corps will attend many of the sessions, to take part in the discussion and to give information that may be of value to the automotive engineers.

LOADS AND DEFLECTIONS OF STAINLESS-STEEL ROUND-WIRE HELICAL SPRINGS—3

Outside Diameter of Spring, Inches	Diameter of Wire, Inches						
	0.0915	0.106	0.121	0.135	0.148	0.162	0.177
Upper Figure, Maximum Safe Load *P*, in Pounds; Lower Figure, Deflection *y*, in Inches per Coil							
5/16	31.6 0.00371	.....	.....	All values in this table are based on 41,250 pounds per square inch fiber stress, and are for severe service. For average and light service, multiply these values by 1.25 and 1.55, respectively.			
3/8	28.1 0.00697	41.4 0.00486	57.1 0.00333				
7/16	25.0 0.0112	37.5 0.00822	53.0 0.00600	70.0 0.00444			
1/2	22.4 0.0167	34.0 0.0125	48.8 0.00949	65.2 0.00727	83.2 0.00574	103.0 0.00438	.....
5/8	18.4 0.0304	28.1 0.0237	41.1 0.0187	57.0 0.0151	71.9 0.0124	92.2 0.0101	116.0 0.00807
3/4	15.6 0.0484	23.9 0.0384	35.2 0.0311	48.2 0.0251	62.5 0.0216	80.2 0.0181	103.0 0.0150
7/8	13.6 0.0708	20.8 0.0570	30.7 0.0467	42.1 0.0391	54.9 0.0334	71.4 0.0286	91.5 0.0240
1	11.9 0.0969	18.4 0.0793	27.1 0.0655	37.2 0.0554	48.5 0.0477	63.2 0.0411	81.8 0.0353
1 1/8	10.6 0.128	16.4 0.105	24.4 0.0879	33.4 0.0745	43.7 0.0648	57.0 0.0562	73.7 0.0486
1 1/4	9.68 0.163	14.8 0.134	22.0 0.112	30.4 0.0969	39.8 0.0847	51.8 0.0736	67.0 0.0642
1 3/8	8.78 0.202	13.6 0.165	20.1 0.141	27.8 0.121	36.4 0.107	47.2 0.0936	61.4 0.0822
1 1/2	8.10 0.245	12.5 0.204	18.4 0.172	25.4 0.151	33.4 0.131	43.8 0.116	56.7 0.102
1 5/8	7.47 0.293	11.6 0.244	17.1 0.207	23.6 0.180	31.0 0.159	40.5 0.140	52.6 0.125
1 3/4	6.94 0.344	10.7 0.287	15.9 0.244	22.0 0.212	28.9 0.189	37.8 0.167	49.0 0.148
1 7/8	6.50 0.400	10.0 0.335	14.9 0.286	20.7 0.249	27.1 0.221	35.3 0.196	46.0 0.175
2	6.10 0.460	9.45 0.386	14.0 0.329	19.4 0.288	25.5 0.256	33.3 0.228	43.2 0.204
2 1/4	5.44 0.593	8.40 0.498	12.4 0.427	17.2 0.375	23.0 0.335	30.0 0.300	38.6 0.267
2 1/2	4.90 0.742	7.58 0.628	11.2 0.539	15.5 0.472	20.5 0.423	26.8 0.379	35.9 0.339
2 3/4	.....	6.90 0.769	10.3 0.662	14.2 0.585	18.7 0.521	24.5 0.469	31.8 0.420
3	.....	6.35 0.928	9.45 0.800	13.0 0.703	17.2 0.632	22.4 0.567	29.2 0.511

For maximum safe load and deflection formulas, see Data Sheet No. 463, April, 1942.

MACHINERY'S Data Sheet No. 465, May, 1942

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

LOADS AND DEFLECTIONS OF STAINLESS-STEEL ROUND-WIRE HELICAL SPRINGS—4

Outside Diameter of Spring, Inches	Diameter of Wire, Inches						
	0.192	0.207	0.225	0.244	0.263	0.283	0.307
Upper Figure, Maximum Safe Load *P*, in Pounds; Lower Figure, Deflection *y*, in Inches per Coil							
1	89.8 0.0266	.....	.....	All values in this table are based on 36,000 pounds per square inch fiber stress, and are for severe service. For average and light service, multiply these values by 1.25 and 1.55, respectively.			
1 1/8	81.3 0.0370	101.0 0.0324	.....				
1 1/4	74.2 0.0492	91.5 0.0432	117.0 0.0373	147.0 0.0321			
1 3/8	68.2 0.0634	84.8 0.0559	108.0 0.0486	136.0 0.0421	167.0 0.0366	.....	.....
1 1/2	62.7 0.0785	78.0 0.0701	99.0 0.0612	126.0 0.0536	155.0 0.0469	192.0 0.0410	.....
1 5/8	58.4 0.0962	72.6 0.0855	93.0 0.0756	117.0 0.0664	146.0 0.0587	179.0 0.0515	230.0 0.0446
1 3/4	54.4 0.116	67.8 0.103	86.2 0.0912	110.0 0.0808	136.0 0.0711	168.0 0.0630	212.0 0.0547
1 7/8	51.0 0.136	63.6 0.122	81.0 0.108	103.0 0.0958	128.0 0.0855	158.0 0.0757	200.0 0.0663
2	48.1 0.160	59.8 0.143	76.5 0.127	96.7 0.113	121.0 0.101	149.0 0.0896	189.0 0.0786
2 1/4	42.8 0.209	53.5 0.189	68.5 0.169	87.0 0.151	108.0 0.135	134.0 0.121	170.0 0.107
2 1/2	38.7 0.267	48.3 0.243	62.0 0.210	79.0 0.194	98.2 0.175	122.0 0.157	154.0 0.139
2 3/4	35.2 0.332	44.2 0.301	56.6 0.270	71.9 0.243	89.2 0.219	111.0 0.198	141.0 0.177
3	32.4 0.402	40.6 0.367	52.0 0.331	66.4 0.298	82.5 0.269	103.0 0.243	130.0 0.217
3 1/2	28.0 0.568	35.0 0.515	44.8 0.469	56.9 0.422	71.1 0.383	88.5 0.348	112.0 0.313
4	.....	.....	39.3 0.629	50.0 0.570	62.1 0.516	78.0 0.474	99.0 0.427
4 1/2	.....	.....	.....	44.8 0.740	55.8 0.676	69.3 0.617	88.5 0.558
5	.....	.....	.....	.....	.....	62.6 0.780	80.2 0.711
5 1/2	.....	.....	.....	.....	.....	.....	72.8 0.879
6	.....	.....	.....	.....	.....	.....	67.0 1.06

For maximum safe load and deflection formulas, see Data Sheet No. 463, April, 1942.

MACHINERY'S Data Sheet No. 466, May, 1942

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

MACHINERY, May, 1942

Tool and Holder for Form-Turning Copper Band on Shells

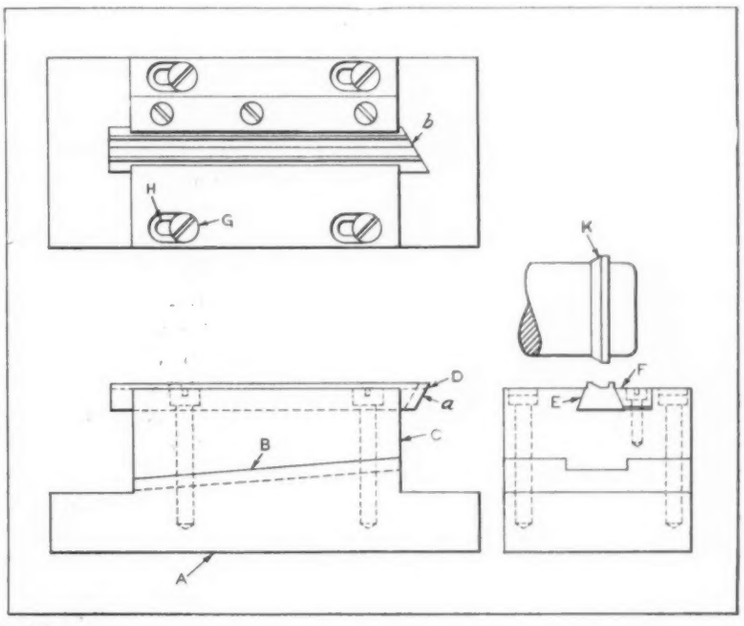
By DONALD A. BAKER
Service Engineering Co., Newark, N. J.

Difficulty is often experienced in turning copper, especially by those who are unfamiliar with the machining characteristics of this metal. Recently, while visiting a factory that was just starting work on a shell contract, the writer watched with interest the setting up of a lathe for form-turning the copper bands. The tool set-up had been planned with the idea of using plain forming tools with no top or side rake. When the tool came into contact with the work, the shell was torn from the lathe centers and thrown about 10 feet from the lathe, the forming tool and one center being damaged.

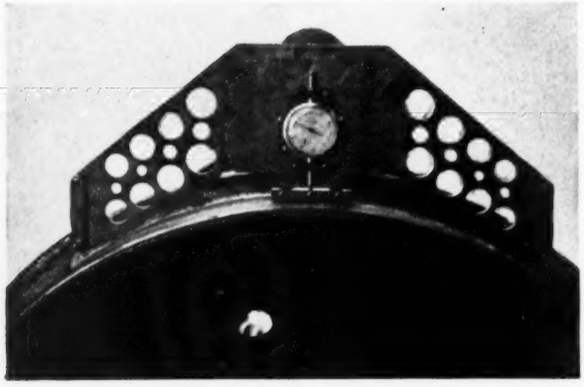
The writer suggested the tool equipment here illustrated, which is now in satisfactory operation. It consists of a cast-iron base *A*, mounted on the back cross-slide so that it can be fed underneath the work. This base has an angular top surface *B* on which the steel block *C* rests. Block *C*, in turn, carries the forming tool *D*, which is held against the angular side *E* of the block by clamp *F*. Block *C* is secured to the base by four screws *G*, which pass through slotted holes *H* that provide adjustment for raising and lowering the tool. When once set to the correct height, no further adjustment is necessary during the life of the forming tool, except to slide the tool ahead as the face is ground off.

In sharpening a copper turning tool, excessive rake must be provided, as copper requires extremely sharp tools because of its soft, stringy nature. The particular tool shown was given rake in both directions as seen at *a* and *b*.

Another point of importance in the design of this tool is that it should be level with the work or copper band *K*, so that as it passes the work, its top surface will act as a burnisher, giving the work a high finish. Care should be taken in making the forming tool to see that the top face is given as smooth a finish as possible, in order to insure a good burnishing action.



Tool and Holder Designed to Take Tangent Cut in Form-turning Copper Band K



Measuring Device for Determining Wear on Treads and Flanges of Subway-car Wheels

Micrometer for Measuring Subway-Car Wheels

By ALBERT MILTON THOMAS
Toolmaker, General Repair Shops
B.M.T. Division, New York City Subways

The accompanying illustration shows a subway-car wheel micrometer developed in the Research Branch of the Engineering Department, B.M.T. Division, New York City Subways, to provide means for obtaining more accurate measurements than were possible with an ordinary micrometer. In an effort to reduce the amount of wear on car wheels, the first problem was to determine what faults, if any, in truck construction were contributing factors to undue wear of flanges and treads. This necessitated accurate measurements, the micrometer shown in the illustration being used, as it was evident that the ordinary micrometer was not sufficiently exact in cases of comparative measurements, when the diameters of the wheels of a given truck or those of the two wheels on the same axle were required.

A study of the cross-section of a subway-car wheel shows that flange and tread are made up of the blending arcs of the flange joined to the one-in-twenty slope of the tread proper. This sloping tread makes it necessary, especially in cases where diameters are to be measured for comparative purposes, that the diameter measurement be taken on all wheels involved at points that are the same distance from corresponding edges, and that these edges be the ones that are not subjected to wear. Also, these measurements must be taken without removing the wheels from the cars.

In the illustration, the micrometer is shown mounted on the wheel being measured. The main body of the gage consists of a steel plate, heat-treated, ground, and polished on both sides to a thickness of about 1/8 inch. The holes shown in the wings of the plate were made merely to obtain lightness, and do not affect the strength of this member. The dial gage is located at a point exactly half way between the extreme ends of the plate.

This gage has a range of 1 inch. Its registering point is always in contact with the small cross-bar resting on the tread of the wheel. The cross-bar is fastened to a sliding piece that moves in smooth ways on the back of the gage and is made of high-speed steel, hardened and ground to shape. The under side is so shaped that it makes a point contact on the tread of the wheel.

At the extreme edges of this plate are two other contact points of hardened high-speed steel. These points are exactly 18 inches apart and 2 1/2 inches below the central and moving point when the dial gage, which registers in thousandths inch, indicates the zero setting.

Two other attachments, fastened to the rear of the plate, are used in conjunction with these points. One of these attachments has a gaging surface that moves in a vertical slide. This is adjusted and held flat against the inner flanged edge of the wheel, thus locating the device in a vertical position. As the inner flanged edge of the wheel is subjected to no wear, the instrument will measure the diameter of the tread at a point the same distance from the inner edge on all wheels.

The other attachment measures the wear on the flange. It is placed on the center of the device immediately under the dial gage and is graduated to read in thousandths of an inch, beginning at zero, which is the measure of a new or properly reshaped wheel. This attachment moves horizontally in its slide, and is actuated by a spring that keeps it pressed against the worn flange at the point where the greatest wear takes place. A small thumb-screw locks this attachment in place, so that the registered amount of wear can be read on the gage when the device is removed from the wheel.

In operation, the micrometer is placed on the wheel as shown, with the distance gage in the rear held firmly against the inner flat side of the wheel, thus holding the tool in a vertical position. The two outer contact points measure off an arc of the wheel of exactly 18 inches. The central point moves the needle on the dial to a point beyond the zero position. The measurement of the depth of arc is equal to 2 1/2 inches plus the number of thousandths of an inch indicated by the needle beyond the zero position. From this measurement, the exact diameter of the wheel can be easily calculated. At the same time, the amount of wear on the flange is shown by the measuring attachment that makes contact with the flange and is locked in place by the thumb-screw before the micrometer is removed.

Simple Device for Eliminating Chatter when Grinding Small Parts

By WILLIAM J. SACK, Oak Park, Ill.

The accompanying illustrations show a simple device used to eliminate chatter when grinding small perforating punches on a lathe equipped with a portable grinder. Several devices were tried out, but the results were unsatisfactory until the one shown in the illustration was constructed. This permits the work to be supported by a leather pad *G*, provision being made for adjusting the amount of support by changing the position of the 12-ounce weight *E* on lever *D*. This device, made of wood and scrap parts, has been used for grinding perforating punches as small as 0.050 inch in diameter without perceptible chatter.

Parts *A*, *B*, and *C*, Fig. 1, are of wood and are made to fit the lathe to be used. Lever *D* is a piece of cold-drawn steel 1/4 by 1/2 by 5 inches, drilled as shown to permit adjusting the position of the weight. A bent nail *F*, which is a snug fit in the hole in the wooden piece *C* and a loose fit in the hole in lever *D*, provides a pivot bearing for the latter member. Pad *G* is a T-shaped piece of leather belting loosely fitted in the slot in part *C*.

The wooden parts transmit little, if any, vibration from the lathe, and the T-shaped piece of leather prevents the perforating punch from vibrating due to the action of the grinding wheel. The rocking movement of lever *D* takes care of any eccentricity in the part being ground. Care must be taken in placing the weight *E*, as too much leverage on small-diameter work will result in grinding a taper on the work. In setting this device, the end of the work is located about even with the edge of the leather pad, which supports it in the manner shown in the illustration.

* * *

Simulated Metal Appearance Obtained with New Finish

A colored transparent finish for use on polished metal, which is not affected by wartime restrictions, is being produced by Maas & Waldstein Co., Newark, N. J., as a substitute for electroplating and for bronze-powder finishes. This finish, which is marketed as "Platelustre," consists of a concentrated enamel, of the desired color, added to a clear lacquer. According to the manufacturer, when applied on polished metals, it makes them resemble copper, brass, bronze, color-treated aluminum and steel, or other metals. Application is by spraying or roller coating, and the finish can be furnished for either air drying or baking. Flat stock finished with certain grades can be formed after baking. Two-color finishes are obtainable by "relieving" operations. The colors are said to be fast to light in indoor service.

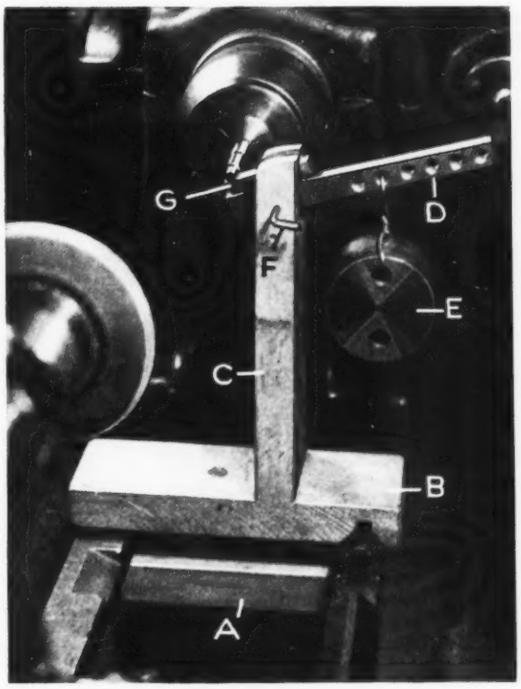


Fig. 1. Device Used on Lathe to Prevent Chatter when Grinding Small Punches with a Portable Grinder

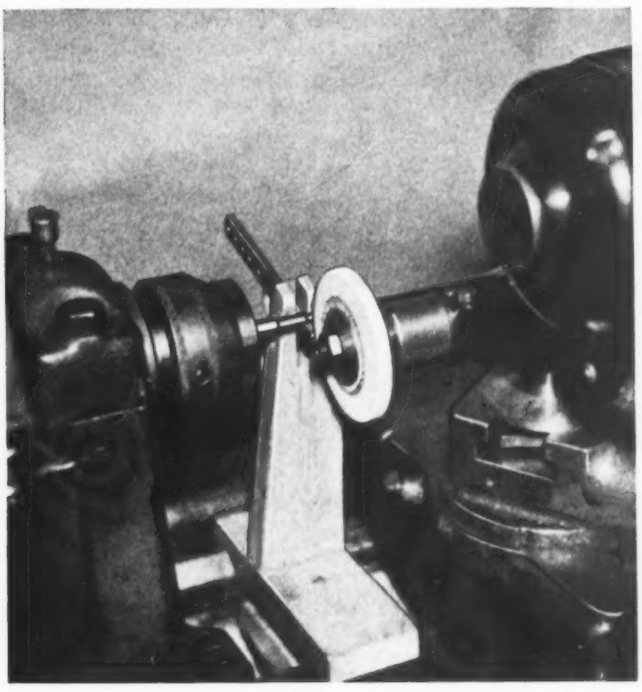


Fig. 2. Grinding the Small End of a Perforating Punch which is Supported by the Device Illustrated in Fig. 1

What the Product Designer Should Know About Plastics

Characteristics and Application of Plastics, and Directions for the Design of Plastic Molded Parts for Economical Quantity Production—Third Installment

By ERIK FURHOLMEN
Chief Estimating Engineer
Chicago Molded Products Corpn.

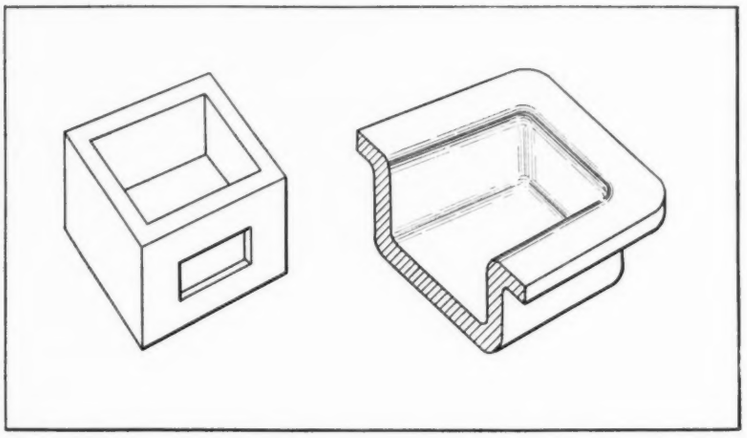


Fig. 5. (Left) Molding with External Under-cut Requiring a Loose Piece or a Side Core in the Mold. Flash will Appear around the Opening Made by the Side Core. Fig. 6. (Right) Molding Indicating where Sharp Corners Should be Avoided and where Used to Advantage. The Upper Edge, which is in the Parting Plane, Should have a Sharp Corner, while All Others, Inside and Outside, Should have as Large Radii as Feasible

THERE are few limitations to the shapes of molded parts. It is advisable, however, to avoid under-cuts, either internal or external, that will restrict or prevent the piece from being readily separated from the mold. This is especially true of restrictions inside the piece. External under-cuts, (Fig. 5) if essential, can be produced by using loose sections to form part of the cavity; but these always complicate the mold and generally result in lines or marks where the flash forms at joints between the loose piece and the mold proper. Such flash often necessitates extra finishing operations, as does also the flash around a side core.

Sharp external corners and edges should be avoided as a rule (except at parting lines), as they increase the cost of the mold and tend to weaken it by inviting fractures. Sharp edges at other points in the mold than the parting tend to restrict the flow of the plastic and may cause weak "weld lines" in the finished product. Fig. 6 shows properly rounded corners.

Abrupt changes in wall thickness (Fig. 7) should be avoided, as they are likely to result in unsightly surfaces, owing to unequal shrinkage of the thick and thin sections and unequal curing in the case of thermosetting plastics. "Sink marks," that is, a tendency to shallow hollows in

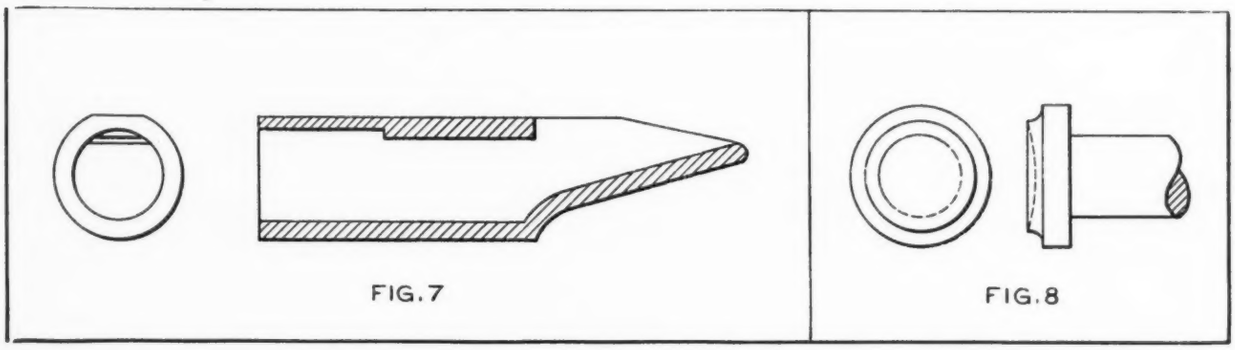


Fig. 7. Abrupt Changes in Thickness of Sections Result in Unequal Shrinkage and Cause "Sink Marks" to Appear on the Outer Surface. By Making the Change in Section Gradual, This Difficulty can be Overcome. Fig. 8. The Dotted Line Shows the Approximate Outline of the "Sink Mark" Resulting from a Thin Head Molded to a Thick Stem

surfaces, or even cracked moldings, may result from abrupt changes in section thickness. A thin head on a stem is likely to show a "sink mark" on the face of the head, as indicated in Fig. 8. This can be avoided by making the head thickness about equal to the stem diameter; or if the head surface is dished slightly, the "sink mark" may not be noticed.

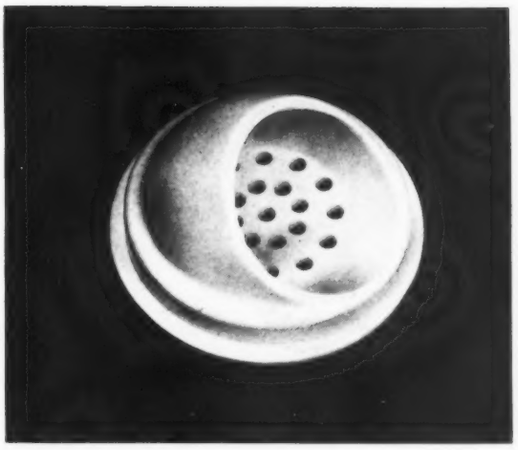


Fig. 9. Telephone Mouthpiece which is Readily Molded

Designs that are "streamlined" have such a relation between their length, width, and depth that they are generally the most economical to mold. Excessive depth, in relation to area or cross-section, presents difficulties, especially if the walls are very thin. The radio cabinet shown in Fig. 15 is a good example of a molding well proportioned in relation to depth and section thickness.

It is generally desirable to design the piece so that the parting line comes in such a position that the removal of the flash is facilitated. If this line lies in a single plane, as in Fig. 6, it makes the mold cost less, and the flash removal is simplified. An irregular parting line, although sometimes required, as in Fig. 10, is always relatively expensive, not only in original mold cost, but also in the "finning" operation.

The parting line usually comes at the maximum diameter of the molding. If the piece is convex at the parting, it is often good practice, if permissible, to add a bead at the parting, as in Fig. 11. The flash is then readily accessible, and is easily removed without marring the rest of the surface. Also, a slight misalignment between the force and the cavity will not be noticeable. If the finished part is circular and can have a groove instead of a bead, as in Fig. 12, this, too, is good practice, as a groove is easily machined on a "finning" lathe. Subsequent filling of the groove with a contrasting color of paint often makes for pleasing appearance.

In the average commercial mold, the force and the cavity are not always concentric or in perfect alignment, especially after the mold is worn. Some allowance should be made for this in designing the part. Whenever possible, it is better to avoid a design that brings the parting line in a place that requires close alignment between force and cavity. Fig. 13 shows a case where alignment may be difficult.

Good design involves the use of a minimum of material, so distributed as to insure sufficient strength at all points. Strength can be assured by selecting the proper material; providing sections of adequate thickness; using well designed and properly located metal inserts, if they are essential; and adding ribs or bosses at the places of greatest stress.

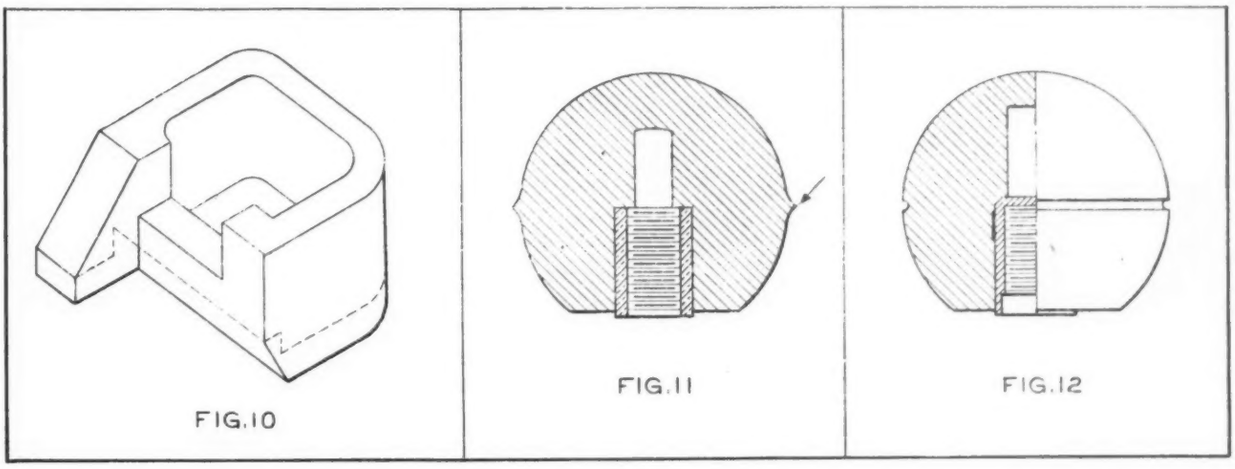


Fig. 10. Molding Having an Irregular Parting. The Dotted Line Shows where the Mold Parts, and Indicates where the Flash Has to be Removed

Fig. 11. Ball Knob with a Bead Molded at the Parting. This Makes it Easy to Remove the Flash without Leaving an Unsightly Mark on the Part

Fig. 12. Ball Knob in which the Flash is Removed by Turning a Groove at the Place where the Flash Occurs. A Nicely Finished Part Results

Economy in production calls for relatively light weight, both because less material is required and because the molding time is reduced. The use of ribs often results in saving weight, as the average section thickness can then often be minimized. The luggage handles seen in Fig. 14 are materially strengthened by the use of ribs and bosses, as well as loop-shaped stamped metal inserts which help to take the stress at the pin where the handles are attached to the bag. Packing and shipping expense is reduced when size and weight are kept at a minimum, and this also promotes economy. Plastics are often chosen in place of other materials to reduce weight.

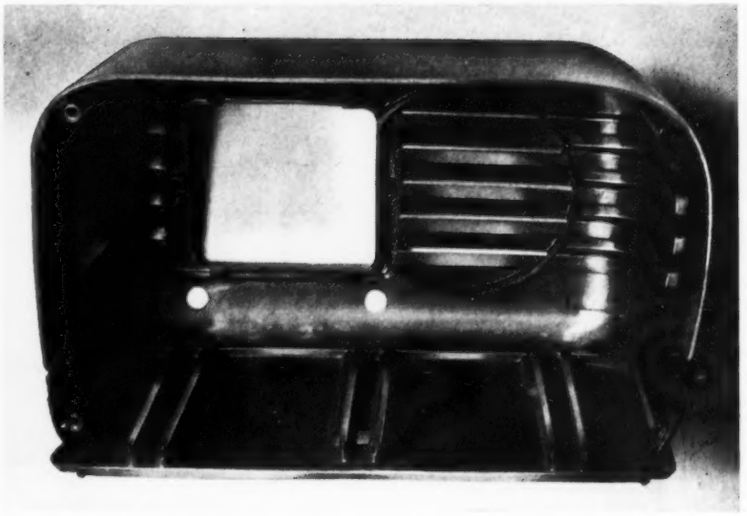


Fig. 15. Radio Cabinet with Well Rounded Corners that Facilitate Molding and Produce a Strong, Good-looking Object

Uniform wall thickness results in maximum molding efficiency, because it enables the molder to use the most advantageous combination of heat, pressure, and curing time. Adjacent thin and thick sections involve compromises, especially with thermosetting plastics, because thin sections cure rapidly and may be over-cured before the thick ones are cured sufficiently. After the molding has been ejected, there is, in addition, uneven shrinkage to consider. This often results in surface imperfections, such as sinking in ("sink marks") at the heavy sections, warpage, brittleness, and, in lighter colored materials, a slight variation in color between heavier and lighter sections.

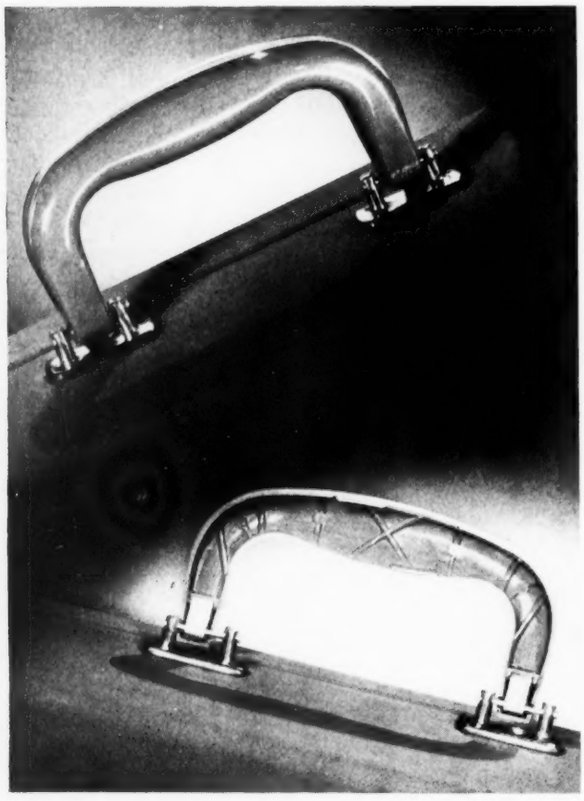


Fig. 14. Luggage Handles Molded Hollow in Two Halves that are Subsequently Cemented together. A Good Example of the Use of Thin Sections with Suitable Ribs and Bosses to Provide Strength while Reducing Weight

When light and heavy sections are required, it is best to use fillets that are as large as possible and to vary the thickness as gradually as conditions permit. Liberal fillets also strengthen both the mold and the molded part, and generally facilitate the flow of the plastic material.

Sometimes a part looks simple enough; but if the part is visualized in the mold, difficulties otherwise overlooked are revealed. It may then be expedient to consider some redesigning to simplify the mold and the molding operation.

Parts having re-entrant curves or under-cuts that prevent ready withdrawal from the mold cavity require that the cavity block be split or that one or more loose pieces be used. This generally increases mold cost, because extra parts are required. The operation cycle is also lengthened, as one or more parts forming the cavity walls have to be removed to release the molded piece. The loose pieces cool off when out of contact with the mold walls, and additional heat and time are required to restore them to the desired molding temperature.

Occasionally, it is possible to have side holes or under-cuts in a molded part without resorting to split cavity blocks. These are made possible by side cores, which are withdrawn mechanically before the mold opens, as in the case of the molding for a telephone mouthpiece shown in Fig. 9.

Fig. 19 shows a mold and molding requiring a side core, and gives some idea as to the extra cost involved in providing side cores and a mechanism to operate them. If three-way (or side-ram) presses are available, one whole side of the mold can be withdrawn before the other parts of the mold are opened.

Split cavities, side cores, and other mechanical means for producing under-cut moldings are entirely feasible, and are in general use. Molds so constructed are, however, relatively expensive to build, slower to operate, involve greater maintenance expense, and the finished molding requires that the parting lines at the mold joints (unless allowed to show) be removed by a finishing operation.

If side holes or openings are required, it is possible to mold these without side cores (which are mechanically withdrawn) and without resorting to split cavities, provided that the wall slopes or that part of it is offset sufficiently to cut off the material as the force telescopes into the cavity. (See Figs. 17 and 20.)

Before draft is specified, it should be determined definitely whether or not it is desirable to have the molded piece cling to the force or to the cavity when the mold opens. This is determined generally by the type of ejection and

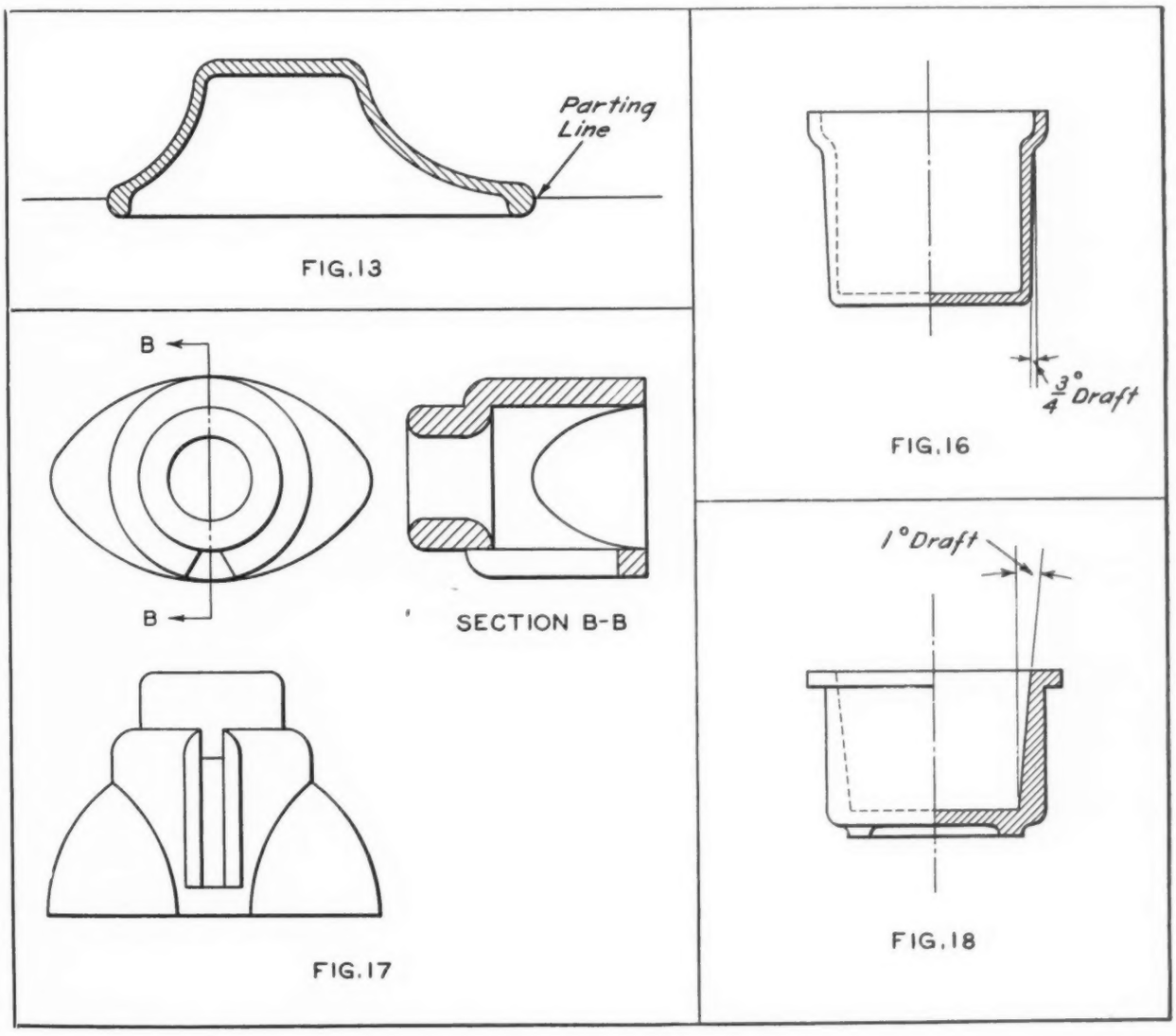


Fig. 13. In This Molding, the Parting Line Comes at a Prominent Point, but the Flash is Easily Removed if the Force and the Cavity are in Perfect Alignment. Fig. 16. This Cup has Practically No Draft on the Inside because, for Ejection Purposes, it is Desirable that the Part Slip Freely out of the Mold Cavity and Cling to the Force. The Draft is, Therefore, on the Outside. Fig. 17. Molding with Offset Wall. An Opening is Formed in the Side Wall by a Projection in the Mold Cavity. There will be a Thin Flash on the Inner Face of the Opening, but No Separate Side Core is Required. Fig. 18. Typical Molding in which the Draft is on the Inside Only. When the Mold Opens, the Force is Freely Drawn out of the Molded Part, the Latter Remaining in the Cavity until Ejected by Push-out Pins

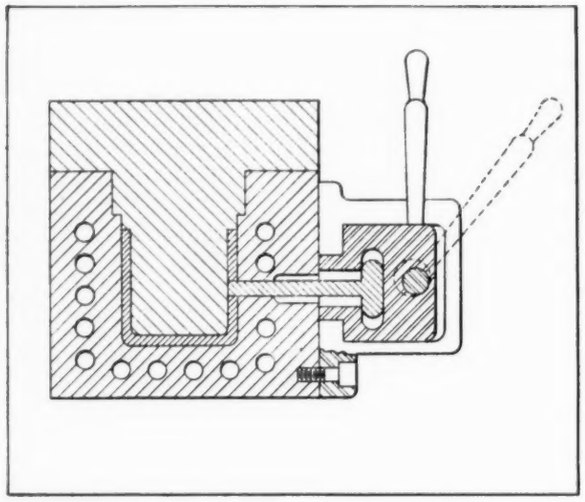


Fig. 19. Mold and Molding in which a Side Core is Required to Form a Hole in the Side Wall. The Core Has to be Withdrawn before the Molding can be Ejected, but Must be in Place before the Next Molding is Made

whether it is permissible to have the ejection or knock-out pins leave their marks. If it is desired that the molding shall cling to the force, as in the case of the molding shown in Fig. 16, the draft should be on the outside (cavity side) of the piece; but if the part is to cling to the cavity, as in the case of the molding shown in Fig. 18, the draft should be on the inside. It is generally not necessary to have draft on both inside and outside of a molded piece. Exceptions to this are found where the cavities are extremely deep and it is necessary to strip the part off the force.

When the mold opens and the part clings to the force, the molding, upon exposure to air, begins to shrink, and sometimes clings so tightly to the force that the molded part is distorted or even cracked when stripped. On deep parts, it is often necessary to have draft on both inside and outside, in order to maintain a fairly uniform wall thickness, as in Fig. 21. The exact amount of draft varies greatly with different materials and depths of draw, but generally ranges between 1/4 and 1/2 degree minimum, on a side, which is ample in most cases.

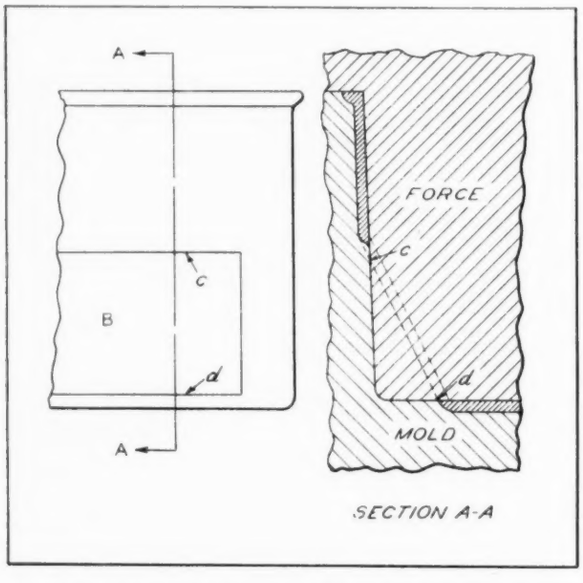


Fig. 20. Molding in which the Opening B, Extending from c to d in an Inclined Wall, is Formed by the Force, as Shown in Section A-A, through the Molding and the Mold; the Hole is Formed without the Use of a Separate Side Core

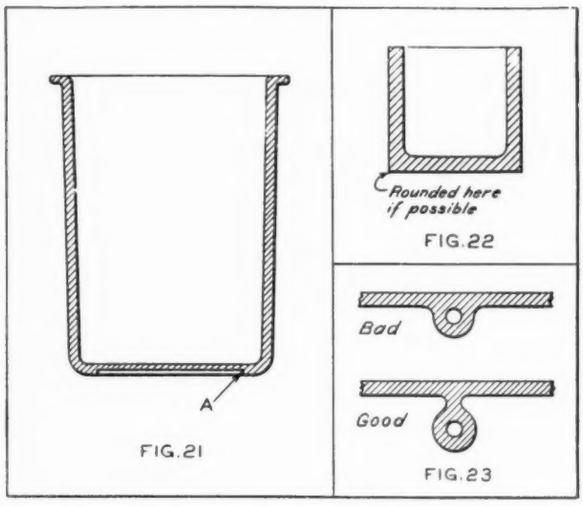


Fig. 21. Typical Beaker which has a Draft Both Inside and Outside. A Slight Shallow Under-cut is Sometimes Made at A to Cause the Molding to Stick in the Cavity. When the Mold is Opened, the Part is Ejected from the Bottom, it being Stripped off the Shallow Undercut. Fig. 22. If the Outside Corners of a Part Have to be Square, the Inside Radius Should Not be So Large that the Wall Section Becomes Unduly Heavy. Fig. 23. Bad and Good Practice in Designing Bosses for Fastenings

The maximum allowable depth of draw (distance that the force must move to clear the molding) also varies with many conditions; but the deeper the draw in proportion to force diameter, and the smaller the draft, the more difficult the molding operation becomes. Still, parts similar to the average drinking glass, which have a fairly uniform wall thickness and considerable draft, both inside and outside, and which are free from restrictions to the flow of material, offer little difficulty in molding.

Generally, fillets and radii are desirable, partly because they offer less restriction to the flow of the plastic, and partly because they tend to strengthen the molded part. They should be so used, however, that they do not materially in-

crease the wall thickness. (See Figs. 22 and 23.) As a rule, radii should appear both on the inside of a part and on the corresponding outside surface, so as to give the wall as nearly uniform a thickness as practical; but for reasons already explained, it is often better to avoid fillets at the mold parting. Fillets and rounded edges generally improve the appearance of a part, besides making exposed corners and edges less vulnerable to chipping. In general, square corners at mold partings can be "broken," that is, slightly beveled or rounded, by a file or other tool used to remove fins, without any significant increase in cost. This makes the edge less likely to be chipped in service.

Where a rib or boss joins a wall having an exposed surface, there should be no undue thickening of the molding, as "sink marks" are then likely to appear, causing an unsightly appearance. Fig. 23 shows good and bad design at such points.

Large flat surfaces should be avoided in designing moldings, as it is practically impossible to produce a molded part in which a large surface is truly flat. Moreover, a slight deviation from true flatness in a surface is readily detected by the eye, and this tends to make any irregularity unduly prominent. A slight crown or some other expedient to avoid flatness usually improves the appearance of the part, and besides, may stiffen it sufficiently to avoid noticeable warpage.

Stippling can often be used to advantage; but, of course, it must be placed in such a location that it does not interfere with the withdrawal of the part from the mold. Stippling tends to hide such surface imperfections as weld lines, orange peel effect, and the like. Surfaces that are crowned or curved, even slightly, result in high-lights which catch the eye and tend to prevent minor surface defects from being noticed. Crowning also results, as a rule, in greater strength.

Beads, recessed lines, and stepped effects are also used advantageously to "relieve" surfaces otherwise flat. Naturally, the curve or other expedient used to improve appearance should be such that it does not increase mold cost unduly or interfere with the withdrawal of the molding. Simple curves are often less expensive to produce than compound curves. The radio cabinet shown in Fig. 15 illustrates the effective use of curved surfaces, as well as of surfaces that are made attractive by the use of ribs or beads, some of which form louvers, though not without some addition to mold cost.

How One Large Company Uses Carbide Tools on Small-Lot Production

CARBIDE tools are used to a very large extent in the production of small lots in the shops of the Falk Corporation, Milwaukee, Wis. This plant employs about 2500 men making products that are not, strictly speaking, made in mass production lots. Typical runs range from 5 to 200 pieces. This presents a tooling problem that must be satisfactorily solved, since the tools must be gotten to the operator on time in order to reduce idle time between set-ups.

In the application of carbide tools, the Falk Corporation has applied the following general principles:

1. Use carbide tools, wherever possible, to obtain maximum output per man-hour and machine-hour. (Approximately 75 per cent of the machining operations in this plant are done with carbide tools.)

2. Use standard carbide tools, wherever possible, to avoid delivery delays and to permit placing them in stock, as well as to simplify grinding.

3. Make up special tools by grinding standard tools to the shape required, wherever possible. This avoids the delays in obtaining special tools and reduces the inventory of such tools. (Practically 90 per cent of the carbide tools used in this plant are either standard or "converted standard" tools.)

4. When it is not possible to make up a special tool by grinding a standard tool to the shape required, the company makes its own tools by tipping standard blanks to special shanks, thereby reducing the inventory to standard tool blanks and avoiding making complete special tools.

5. All new machines installed in the plant must be able to operate at the speeds required for taking full advantage of carbide tooling.

6. The position of "carbide tool engineer" has been created. The carbide tool engineer supervises purchases of tools and blanks, and tool design and grinding, and has charge of tool applications and stock maintenance.

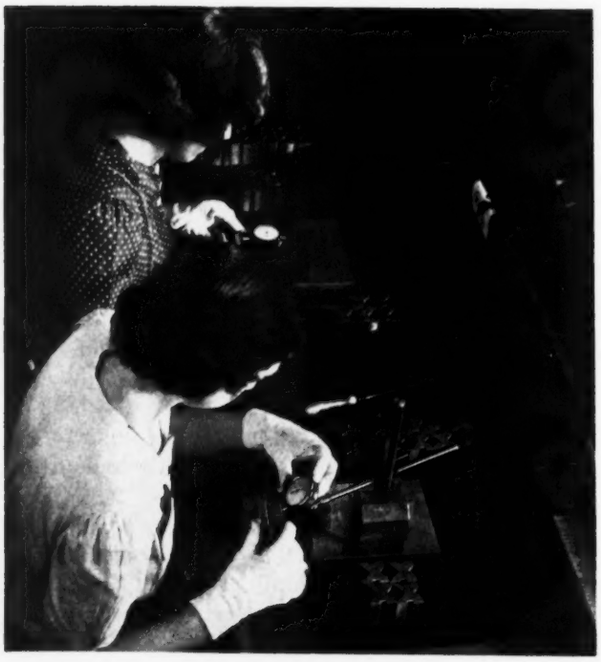
* * *

One way to help in the war effort is to share your knowledge of time-saving methods and devices with others.

Conversion from Peacetime

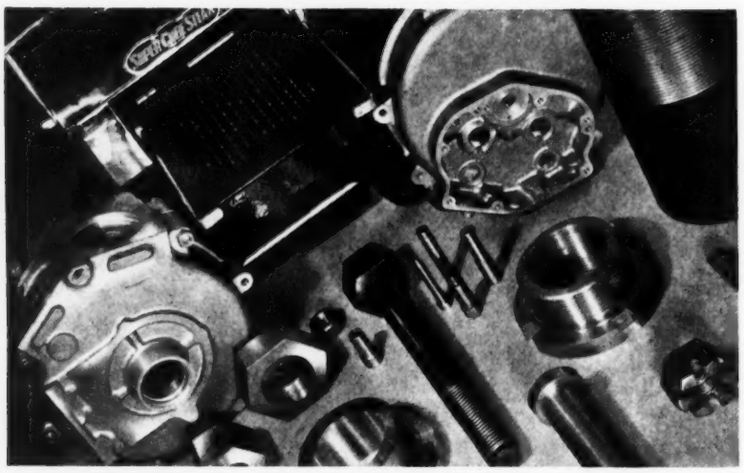
A Safety Razor Plant in New England, Employing Many Women Workers, is Making Razor Blades No Longer, but is Filling a Sub-contract for Machine Tool Auxiliary Equipment

VICTORY



In the Safety Razor Plant Converted to Making Machine Tool Parts, Almost All the Inspection is Done by Girls with the Aid of Modern Precision Gaging Equipment

VICTORY



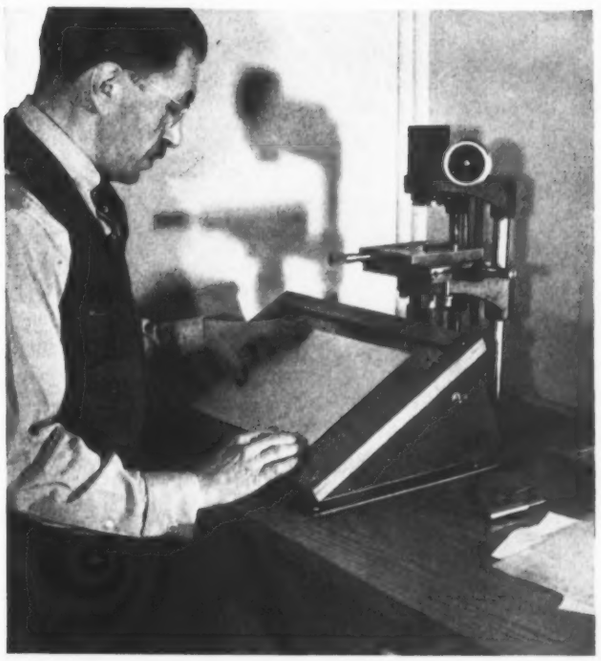
An Example of Conversion from Peacetime Products. This Factory, Formerly Making Cube-steak Machines, after a Certain Amount of Retooling, Now Turns out Aluminum Crankcases, Bronze Flanges, Screw Machine Parts, etc.

to War Production

Courtesy O. E. M.
Photos by Hollem and by Gruber

This Man, Formerly a Weaver and Loom Repair Man, is Working in a Small Factory that Previously Made Floor-waxing Equipment and Now Produces Small Parts for Gun Mounts

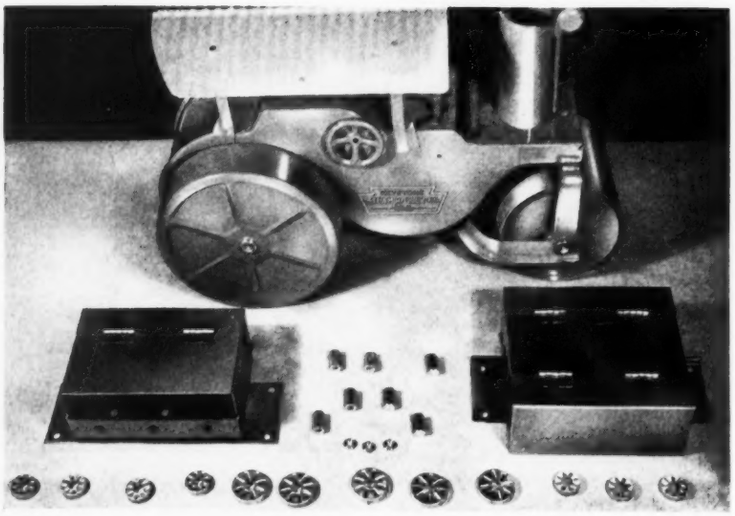
VICTORY



A Soft-drink Dispenser Manufacturer Now Makes Tools and Gages for the Army Arsenals. The Gages for Cartridges Made in This Shop Must be Accurate to 0.0002 Inch

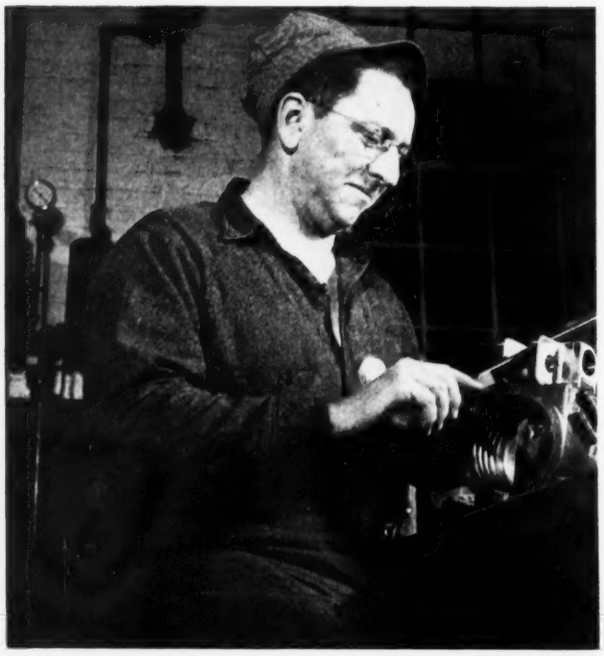
VICTORY

This is a Close-up View of Some of the Products Made by a Factory Formerly Making Orange-juice Squeezers, Game Boards, and Similar Equipment. The Plant is Now Making Gages and Dies for 20-caliber Cartridges



This Illustration Shows a Radical Conversion Job—a Change-over from Various Types of Toys Like the Steam Roller Shown. Today This Plant Makes the Radio Filter Boxes for Tanks Illustrated

VICTORY



Change-over of Jobs as well as of Plant Products. A Former Truck-driver is Now Assembling Parts for a 37-millimeter Gun Built in a Factory that Formerly Made Safes

VICTORY

This Man is Checking and Inspecting a 37-millimeter Gun Mount Made by a Plant Geared to Precision Work because of its Former Experience in Making Safes with Complicated Lock Mechanisms

Grinding Anti-aircraft Gun Barrels in a Plant that was Formerly Devoted to the Manufacture of Safes and Safe-locking Mechanisms. The Experience of the Workers Insures the Required Accuracy

VICTORY

A Thread-grinding Operation Performed on a 37-millimeter Gun in a Safe and Lock Plant. The Change-over to War Work is Simpler in Shops Experienced in Precision Work

VICTORY

Performing Some Welding Work on a 37-millimeter Gun Mount. This is also a Product of the Organization that Formerly Devoted its Efforts to the Making of Safes and Precision Locking Mechanisms

Westinghouse Machine Tool Forum

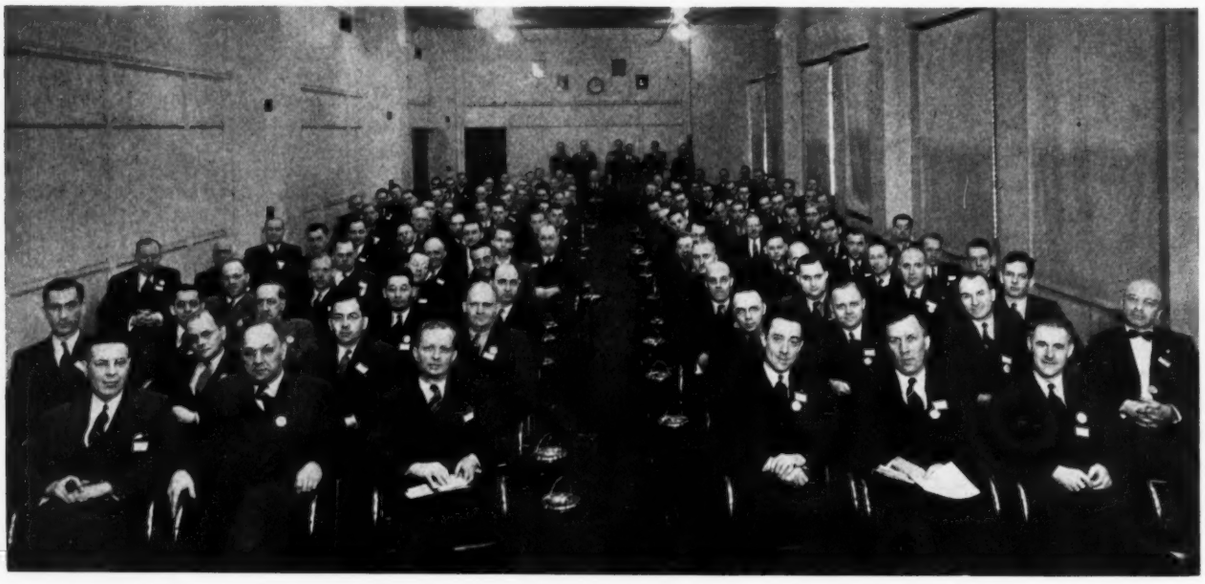
THE annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric & Mfg. Co. at its East Pittsburgh plant, was held Monday and Tuesday, April 6 and 7. There were more than one hundred machine tool designing engineers present, representing nearly one hundred machine tool building firms. At the four sessions, papers were read on a number of subjects pertaining to the electrification of machine tools and other industrial machinery, and opportunities were provided for discussion on the part of the attending engineers.

The meeting was opened by L. F. A. Mitchell, of the Westinghouse organization, who welcomed those in attendance and who spoke briefly on the aims and purposes of the Machine Tool Electrification Forum.

During the various sessions, the following papers were read: "Electrification of Specialized Machines and Tools," by William P. Beattie, The American Laundry Machinery Co.; "Electric Controls as Applied to High-Speed Automatic Machinery," by V. T. Grover, American Can Co.; "The Adjustable Speed Drive as an Aid to All-Out Production," by G. A. Caldwell, Westinghouse Electric & Mfg. Co.; "Thread Grinding with Electric Control," by Lee M. Davis, Jones & Lamson Machine Co.; "Metal Cutting Forces and Power Developed in Machine Tools," by Professor O. W. Boston, University of Michigan; and "The Progress of Electrical Equipment for Machine Tools and Adaptation of Standard Equipment to Speed Production," by Claude E. Greene, Monarch Machine Tool Co. A round-table discussion, with E. M. Taylor, of the Heald Machine Co. as chairman, covered the subject "Recent Developments in the Balancing of Precision Motors." Another discussion session was conducted by Tell Berna, general manager of the National Machine Tool Builders' Association.

At a dinner given by the Westinghouse company to the engineers attending the Forum, Frederick B. Heitkamp, vice-president of the American Type Founders, Inc., gave an inspiring address on industry's war effort. Mr. Heitkamp's address was entitled "Problems Involved in Plant Conversion to War Work," but, actually, it was much more than a discussion of industrial problems.

While dealing with the problems of conversion to war work, Mr. Heitkamp covered, among other things, the matter of sub-contracting. "In trying to find sub-contractors," Mr. Heitkamp said, "it becomes necessary to weed out a great many manufacturers and shop proprietors who may want to do war work, but who are really not equipped to do it. When a sub-contractor has been finally selected, the prime contractor's responsibility does not end. It then becomes necessary to help him in developing his production methods, and even to supply him with machine tools and to help him in the manufacture of jigs, fixtures, and gages. In many sub-contracting plants, it has been found necessary for the prime contractor to place resident production engineers to expedite the work, help to



Group of Engineers Attending the Westinghouse Machine Tool Electrification Forum

solve production difficulties, supervise the inspection, and in general, represent the prime contractor as a resident manager in that plant."

"This whole war program," said Mr. Heitkamp, "has very definitely shown that many of us who thought that our plants were capable of manufacturing almost anything, actually have had a great deal to learn about the change-over from one product to another."

Speaking specifically of his own experience with sub-contracting, Mr. Heitkamp said, "It multiplies the normal type of manufacturing procedure several times. Any management would prefer to have under one roof all of the manufacturing problems. But multiply this by forty-three different units, located in different geographical areas, all of which have had to convert from their normal product to a new product, and you can see the difficulties that are involved. Furthermore, we have had to supply the sub-contractors with materials and locate sources of supply for castings, forgings, and bar stock—in fact, all raw materials.

"We have had to establish the proper contacts with the Ordnance Department to set up a means of inspection supervision by local Ordnance Divisions in these sub-contractors' plants. Designs are being constantly changed to improve the products where faults have been found in actual combat, which still further adds to the complication of manufacture."

Mr. Caldwell's paper on "The Adjustable Speed Drive as an Aid to All-Out Production" will be abstracted in an article that will appear in a coming number of MACHINERY.

Conservation of Welding Electrodes Vital to the War Effort

Clayton B. Herrick, welding engineer of the Lincoln Electric Co., calls attention to the importance of utilizing welding materials to the greatest advantage in order to speed war production. This is especially applicable to welding electrodes.

There are a number of things that affect the most efficient use of electrodes. These Mr. Herrick lists as follows: (1) Select the right type of joint, and be careful of the "fit up"; (2) choose the correct type of electrode; (3) use an electrode that has and maintains a uniform coating; (4) use electrodes that have the right physical properties; (5) use fast-flowing electrodes whenever possible; (6) select an electrode that keeps spatter and slag loss at a minimum; (7) whenever possible, use electrodes that produce flat beads; (8) select the right size of electrode; (9) use long electrodes in the large sizes; (10) do not bend electrodes; (11) use correct voltage and current settings; (12) follow the procedure specified by the manufacturer of the electrode; (13) avoid using an excessive number of beads; (14) use the electrode down to the minimum stub end possible; (15) collect and save stub ends of electrodes; and (16) use modern high-capacity welding generators.

Detailed information relating to how these rules can be most advantageously observed can be obtained by communicating with the Lincoln Electric Co., Cleveland, Ohio.

The Factories of America Must Win the War

There is a war on. It is the most widespread, the most destructive, and probably the most significant war the world has ever known, and we are in the middle of it. We and our allies have to win this war if we want our children to live in the kind of world that we believe in. All of us have to realize this and get busy.

This war is going to be won—or lost—in the factories of America. We are not going to have to worry about the available man-power of our Navy or of our Army, or about the fighting quality of that man-power. Neither are we going to have to worry about either the available man-power or the fighting quality of our allies. The events of the last few months have proved that.

But of what avail is a Navy without ships? What good is a modern Army without tanks and trucks? And what can any sort of modern fighting force do without guns and ammunition and, above all, planes? We, in this country, must be the arsenal of all the democracies. That is our major, our indispensable job. If we fall down on it, the war will inevitably be lost. We must face that fact and make our every decision in the light of it.—Dr. Harvey N. Davis, President of Stevens Institute of Technology

Priorities Red Tape Causes Waste in Our War Effort

IN the effort made by our Government to preserve materials in order to conduct the war more efficiently, so much red tape has crept in that, in certain instances, it appears as if there were more effort wasted and more loss of time and work due to complying with the regulations than if there were no regulations at all. One phase which merits close scrutiny and possible correction on the part of those in control of the War Production Board is the amount of "paper" work required in putting through small orders for materials essential in war production.

A typical example of this voluminous amount of paper work is furnished by a recent order for arc-welding electrodes received by the Lincoln Electric Co., Cleveland, Ohio. The order was prepared with painstaking care, indicating the lengths to which industry is going to comply with all Government regulations.

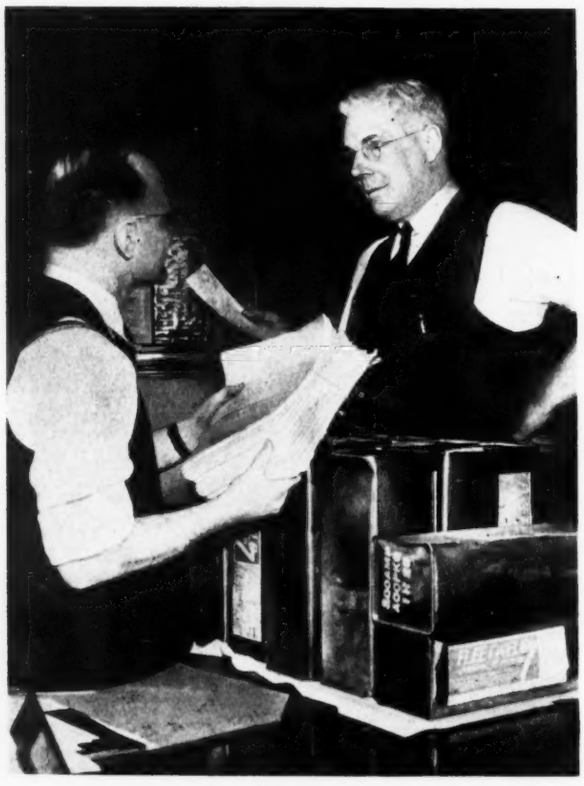
The order itself occupied but a single sheet of paper. It called for 700 pounds of arc-welding electrodes, the total selling price of which was, exclusive of freight, $40.90. This order was accompanied by 199 priorities, each of which consisted of three sheets of standard 8 1/2- by 11-inch mimeographed forms, making a total of 597 separate sheets of paper, all of which required filling in on the typewriter. In addition, each of the 199 priorities required two signatures, one by a notary, as evidenced by the notary seal. The weight of these priority extension papers was actually 5 1/4 pounds. In other words, 5 1/4 pounds of paper, which is, itself, a material that we have been asked not to waste, accompanied a single order which was itemized in less than a typewritten page.

The important thing to be noted is that, according to the company who received the order, this case is by no means an extreme one. More time was actually spent with pen, pencil, and typewriter in preparing the papers required for ordering the electrodes than was required for producing the electrodes themselves. The cost of the extra paper work also greatly exceeded the cost of producing the electrodes. Another important point is that while industry is exhorted to speed up its war effort and its production, there was a serious delay necessitated by obtaining and executing 199 priorities. The time spent in this way was a sacrifice of actual production.

The incident is recorded here not in the spirit of criticism, but in an effort to call attention to a condition believed contrary to the best interests of war production, and to suggest the adoption of a remedy. It is published merely in order to ask the question whether a large part of this paper work might not be eliminated and the time and effort saved be redirected to the nation's main job of producing war equipment.

It is believed when this matter is called to the attention of those who have the power to remedy it, this waste of effort will be eliminated. The man-hours of work spent in handling this one order by the manufacturing concern that issued it, were sufficient to produce a sizable volume of the concern's war product.

Since this paper work is a daily requirement throughout the war industries, literally millions of man-hours are being spent in this non-productive work, whereas this effort could be applied to actual war production. The wasted effort applies to both buyer and seller. It applies both to the company that makes out the order and to the company that fills it, because of the time required by the latter in checking and handling the mass of papers.



Less "Paper Work" would Speed War Production. The Illustration Shows W. A. Dewald of the Order Department of the Lincoln Electric Co., and J. F. Lincoln, President of the Company, Examining 5 1/4 Pounds of Priority Extensions which Accompanied a Recent Order for Arc-welding Electrodes Valued at $40.90. The 199 Priority Extensions Required the Filling in on the Typewriter of 597 Sheets of 8 1/2- by 11-inch Mimeographed Forms

A New Type of Shop Practice Book

MACHINE TOOLS AT WORK. By Charles O. Herb. 544 pages, 6 by 9 inches; 434 illustrations. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $4.

This book, as its title indicates, deals throughout with machine tools in action, and shows actual examples of shop practice. These examples have been carefully selected from the best equipped shops in the United States to illustrate a wide range of applications of modern machine tools. The 434 illustrations showing outstanding jobs from all types of machine-building plants are believed to constitute the most unusual series of shop practice photographs ever assembled in one volume. These illustrations represent jobs on a large variety of the most modern types of machine tools, such as are used for turning, drilling, milling, planing, grinding, broaching, etc.

All operations of the same general character are grouped together, thus showing a wide range of applications for each type of machine tool included. For example, one chapter contains unusual operations on lathes of the ordinary type; another chapter features turret lathe operations; and other sections or chapters feature automatics for bar stock; automatics of the chucking type; thread cutting with dies; milling external and internal screw threads; grinding screw threads; tapping operations; drilling holes with machines of both single-spindle and multiple-spindle types; boring with standard and special machines; cutting-off and other preliminary cutting operations on bars and plates; standard and special punching and riveting operations on sheets and plates; planing, shaping, and slotting operations; milling on various classes of horizontal and vertical types of machines; broaching, grinding, honing, gear-cutting, and a variety of miscellaneous jobs on both standard and special machine tools.

Clear, close-up views show not only the actual machining operations, but the tooling, work-holding, and other auxiliary equipment. These views are all accompanied by the main facts about each job, with specific data on speeds, feeds, production rates, etc., in many cases.

This book differs from ordinary treatises on machine shop practice in that it is much broader in scope, and features throughout the more unusual classes of operations on standard machines, as well as applications of the most highly developed special machine tools. It is intended not only to supplement the shop or school course, but also to provide the machine shop executive or production manager with a general work of reference covering the practice in many classes of thoroughly modern shops. The examples of work selected and the types of machines and tool equipment used illustrate principles and methods that are applicable to many other classes of work.

Westinghouse Apprentice Training

BY means of expanded apprentice courses and special training classes, more than 4000 men and women are being taught trades vital to the manufacture of war materials in the various plants of the Westinghouse Electric & Mfg. Co. Within the last twelve months, some 1500 men have completed such courses, and are now using their newly acquired training and skill in the battle of production.

Semi-skilled men have also been "up graded," having been promoted from simple automatic machine operations to more complex machine work. In this way, the company has been able to draw upon the training of its own people during the period of rapid expansion. In the heavy production departments, emphasis has been placed on the training of men, but women are also doing many important tasks in war production. The total number of women employes of the Westinghouse company is now over 18,000.

At the plant where Westinghouse manufactures steam turbines and other ship propelling equipment, 1600 men are now enrolled in an extensive ten-month course in machine operation. The need for skilled men in the drafting-rooms has been met in part by training outstanding high-school students. This training program as a whole includes 1100 young men. In addition, the Westinghouse company maintains regular apprentice training courses which have been greatly expanded to meet the demands of war production. These apprenticeships are completed in two or four years, depending upon the trade to be learned.

* * *

All that any of us have a right to do while this war continues is either to work or to fight. —*R. L. Giebel, Giebel Machine Tool Co.*

Machine Tool Builders Discuss War Production Problems

THE fortieth spring convention of the National Machine Tool Builders' Association, which was held at the Edgewater Beach Hotel, Chicago, Ill., April 13 and 14, was attended by a larger number of machine tool building executives and engineers probably than any other meeting held by the Association. All the sessions were devoted to discussions of problems connected with the production of war materials.

George H. Johnson, President of the National Machine Tool Builders' Association

The meeting was opened by the president of the Association, George H. Johnson, president of the Gisholt Machine Co., Madison, Wis. In his address, Mr. Johnson pointed out that the machine tool industry's record of expanded output takes on a new significance because the country is at war. He emphasized that, because of the enormously increased production of machine tools during the last three years, the United States and England have today tanks, planes, guns, and ships on the firing line, and vast factories are now tooled up to turn out military equipment in enormous quantities. Most of the weapons with which the Allied armies fight today are made on the machine tools that the American machine tool industry built in 1939, 1940, 1941.

Continuing, Mr. Johnson said: "I know that every one of you here today will agree with me that, regardless of what the difficulties and the obstacles may be, regardless of what may stand in the way of all-out accomplishment, our job will be done, it will be *well* done, and it will be done *in time*. That is the challenge before this meeting today.

Operating Plants Twenty-Four Hours a Day, Seven Days a Week

"Now let us take up some of the problems which must be met and solved if we are to achieve the all-out production required for Victory. First of all, there is the problem of continuous operation, twenty-four hours a day, seven days a week. I am glad to report at this meeting that practically every machine tool builder is today actively engaged in converting operations to this basis.

"I know from experience within our own plant the many obstacles encountered. Of course, it is difficult to build up the second shift—and still more difficult to build up the third shift. It seems almost impossible to obtain the supervisory personnel needed to cover three full shifts. Also, the output of a plant is limited by the output of certain critical machines. But it is of little consequence to explain why the desired objective is difficult of accomplishment. All of the reasons which any one of us might bring forward to explain why some of our machines are idle eight hours out of twenty-four, or on Sundays, would seem pitiful to an American private helping to hold Corregidor.

"The fact is that we in this industry must do what it seems impossible to do. We must get and hold 168-hour operation. In cases where output is limited by the operation of critical machines, production may be brought into balance by sub-contracting work which you cannot do in your own plant.

The Problem of Materials

"A second broad problem which faces us is the problem of materials. The War Production Board has already requested our foundries to stop using nickel in castings. This is only a forerunner of the drastic reduction of all the vital alloy metals, such as nickel, vanadium, tungsten, molybdenum, chromium, manganese, and others, in products not actually used by the armed forces. Already, excellent results in reducing the use of aluminum to the minimum have been secured by your cooperation.

"This is a situation in which we must cooperate to the fullest extent. It means using all of the engineering and designing skill at our

command to develop substitutes for these critical materials. We must recognize that war brings emergencies; and that shortages of critical materials do not reflect arbitrary decisions by Government officials, but dire need.

The Problem of Finding Machine Operators

"A third major problem is that of men. Continuation of occupational deferment from the draft is by no means assured. If the man-power requirements of the armed forces are great enough, a high percentage of the men between twenty and thirty-five must be called to the colors. This means that we must be prepared to employ and train men who are not likely to be called—men beyond the draft age, men with many dependents, and men with physical impairments that will not seriously interfere with their productivity as workmen in our plants.

"Furthermore, we must begin right now to consider the employment of women. We are told that in England and Canada 60 per cent of the machine operators in factories are women. The chief engineer of our company recently returned from inspecting Canadian munitions plants, and told me that in Canada women were operating planers and boring mills. The employment of women requires its own special set-up with respect to plant supervisory personnel and welfare facilities. However, it is my opinion that before this war is over, most of us will employ large numbers of women; and we will be particularly grateful to our designers and engineers, who, over the last ten years, have contrived to plan machine tools in such a way that their operation involves the use of push-buttons and easily handled levers rather than mere muscle.

"All of this presents to us the need for training programs on a broader and more extensive basis than have ever been undertaken before. We must teach men who cannot qualify for military service how to run machines. We must teach women how to run machines. We must develop supervisory forces to get these men and women into production and keep them operating our machines on a balanced 168-hour week. These, I believe, are the major problems, the real problems, which confront the industry today. They can and they must be solved.

Give Us a Chance to Build Machine Tools Instead of Answering Questionnaires

"But it is certainly to be hoped that, in turning our full attention toward solving these major problems, we may be freed from some of the difficulties and entanglements which arise partly from an excess of zeal on the part of some of the people in Washington, and partly from the accumulation of red tape, which apparently is part of any war production picture. You all know what I am going to say next. The word is 'questionnaires.'

"I do not blame any of the people in Washington who are sending questionnaires to machine tool builders. Every one of these men is no doubt sincerely interested in getting what he believes to be important information. Each one sends out his own questionnaire. But the total is staggering. I doubt whether any one department that sends a questionnaire to machine tool builders has any conception of the number of questionnaires the machine tool builder is getting from other departments. I think that at this meeting we might well send to Washington, in a very amiable spirit, a protest to all compilers of questionnaires. I think we might well ask them to please stop making us fill out blanks and let us get down to the business of making machine tools.

Don't Forget that War Conditions Make Many Inconveniences Necessary

"Now—in conclusion—there are a great many things about the situation in which we find ourselves today which we do not like. We do not like the extent to which the Government has entered into the conduct of our business. We do not like the criticisms to which many of us have been subjected by various agencies of the Government. We do not like governmental rules, regulations, and questionnaires.

"To all of that I have only one answer. These things are part and parcel of the picture of a nation at war. Remember that, along with governmental investigation and regulation and red tape, have come governmental financing of pool orders and governmental cooperation with respect to many phases of our business. Bear in mind that, in this whole situation, the major objectives of our industry and the major objectives of the Government are identical. Both are today dedicated to production for Victory. Such differences, therefore, as arise today are differences in method.

"Therefore, I say—let's take whatever we must take as the fortunes of war. The machine tool industry is today, as I see it, a division of the fighting forces of the United States. We are fighting, in our own way, the battle of America. We are fighting it with the tools and with the ingenuity which we particularly are qualified to bring to this emergency.

"It is up to us to do this job. We must do it in spite of all the obstacles and the difficulties and the seemingly unnecessary burdens that are tossed in our laps. We must make more machine tools, more than we ever dreamed of before, *just as fast as we can.* That is our Program for 1942."

Warner & Swasey Motion Picture on the Grinding and Setting of Cutting Tools

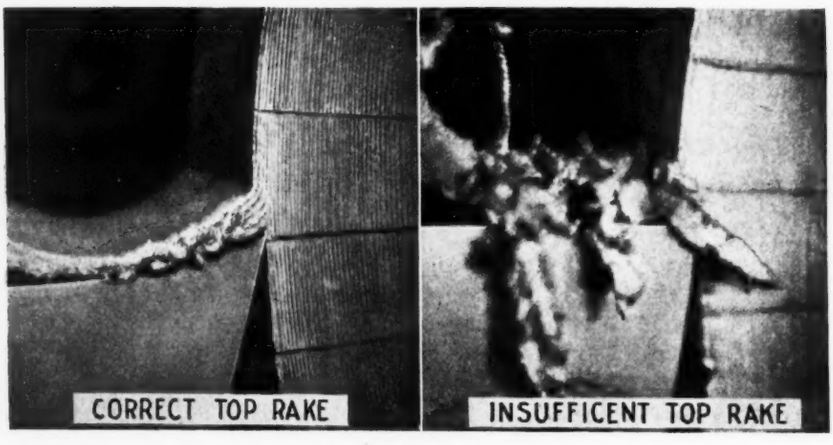
Slow-motion "Close-ups" in the Warner & Swasey Moving Picture "Chips," Showing the Chip Formation when Machining Steel, Cast Iron, and Brass

THE Warner & Swasey Co., Cleveland, Ohio, has made arrangements to supply a staff of instructors especially trained in the technique of grinding and setting cutting tools to conduct a one-hour session on the subject in metal-working plants and machine-operation training institutions throughout the country. The instruction is designed to be given in plant meeting rooms when shifts are changed, or at any other convenient hours.

The program includes as its chief feature a remarkable high-speed sound moving picture, so produced that it slows up and magnifies metal-turning operations, and thus clearly indicates what happens when cutting tools are in action. The instructors and the film will be available upon request without charge as one of the services of the company's Turret Lathe Operators' Service Bureau. The company began giving instruction in turret lathe operation a year and a half ago by programs arranged in metal-working plants. Since that time this instruction has been given in over a thousand factories.

In the course of conducting these programs, the instructors found that the questions that predominated related to the grinding and setting of tools and cutters. For that reason, the company decided to launch this new course, which is devoted to the grinding and setting of tools exclusively. In addition to the sound film, the instructors use model tools and enlarged model cutters and charts. A sixteen-page booklet giving the high spots of the subject is distributed to the operators who attend the session.

The sound film has properly been labeled "Chips." It shows at one-hundredth of the ac-



Close-up Views Showing Effect of Correctly and Incorrectly Ground Tools. In This Case, the Effect of Correct and Insufficient Top Rake is Illustrated

tual speeds what happens when a cutter is ground correctly and what happens when it is ground incorrectly. It includes instruction in the use of chip grooves, shows how to control the size and length of chips, illustrates the function of coolants, and emphasizes the advantages of honing cutting tools.

The lessons emphasize that the performance of the cutting tools determines more than any other single factor the extent to which the operator gets out of his machine all that has been built into it. As a rule, the capacity of machine equipment is not utilized to the maximum degree, and every effort should be made to employ that capacity to the fullest extent. There is a great need for training, not only of the new men who are joining the country's huge production army every day, but of the thousands of experienced operators who are not fully versed in the best operating methods.

* * *

Gear Manufacturers to Meet in Hershey

The American Gear Manufacturers Association will hold its twenty-sixth annual meeting at the Hotel Hershey, Hershey, Pa., May 10 to 12. Sessions will be held Sunday afternoon, May 10; Monday morning and afternoon, May 11; and Tuesday morning and afternoon, May 12.

Among the papers to be read before the meeting may be mentioned the following: "Physics of Metal Cutting," by Dr. E. M. Martelotti, Cincinnati Milling Machine Co., Cincinnati, Ohio; "Gear Production by the Hobbing Process," by Louis W. Falk, The Falk Corporation, Milwaukee, Wis.; "Cutting Gears and Other Parts with a Reciprocating Tool," by George H. Sanborn, Fellows Gear Shaper Co., Springfield, Vt.; and "Cutting Gears in Farrel-Sykes Gear Generators," by Harry E. Kitchen, Farrel-Birmingham Co., Buffalo, N. Y. Further information can be obtained from the headquarters of the Association, 602 Shields Bldg., Wilkinsburg, Pa.

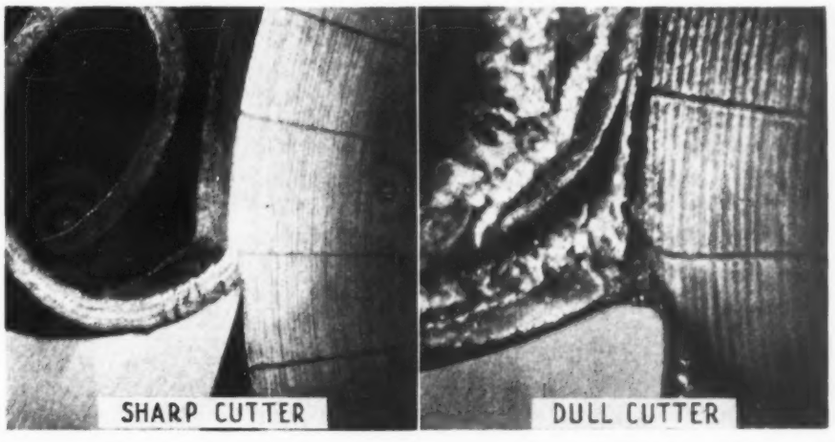
Cincinnati Milling Machine Co. Receives Navy "E" Award

Formal presentation of the "Navy "E" pennant, originally announced on March 6 by the Secretary of the Navy, Frank Knox, was made to the Cincinnati Milling Machine Co. March 20 at a ceremony preceded by a plant visitation and reception in the company's new engineering and service building. The award was made "for outstanding production achievement."

Prominent business leaders and industrialists, and a large number of Navy and Army officers, joined with the employes and executives of the company at a ceremony presided over by the Mayor of Cincinnati, Honorable James Garfield Stewart. Prior to the formal presentation of the Navy "E" pennant by Rear Admiral Clark H. Woodward, the governor of the state of Ohio, Honorable John W. Bricker, spoke to the assembled group. Admiral Woodward emphasized that machine tools are at the very core of the war effort, and are back of our drive for victory.

In accepting the award, Frederick V. Geier, president of the Cincinnati Milling Machine Co., said: "What we have done in our effort to serve the Navy and all the fighting forces of our country has not been the work of any one man or any one group, but truly the result of the united determined teamwork of every employe and every department, working in the great spirit of service of our founder. To give credit where credit is due would be to read the names of every employe and every sub-contractor."

The Navy "E" buttons—each of which carries a ship, the Navy anchor and eagle, the legend "For Production," and the superimposed Navy "E"—were presented by Commander G. H. Bowman, chief of the Cincinnati District Inspection Office, to the four employes having the longest service records; Edward "Bud" Sand, Ed Pandorf, William Ennix, and Adam Fath. Sand, who responded for the employes, has been with the company for more than fifty-eight years.



Pictures from the Motion Picture Film on Metal Cutting, Showing what Happens when a Sharp Cutter and when a Dull Cutter Remove Metal

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Abrasion-Resisting Ceramic Used in Air-Blast Nozzles

An extremely hard, abrasion-resisting ceramic, "Heanium," is now being used instead of metal for the inserts of "Long-Lyfe" nozzles manufactured by the American Foundry Equipment Co., 399 S. Byrkit St., Mishawaka, Ind., for air-blast cleaning equipment. The product is the result of years of research in the field of colloidal chemistry.

The ceramic insert is said to have a hardness and density that is superior to many of the metals now being used for this purpose. Its manufacture is not affected by the present scarcity of certain metal alloys. The nozzle wears slowly and evenly, and since the original orifice is preserved without appreciable wear after hundreds of hours of service, the contour of the blast stream remains unchanged and its efficiency is thereby maintained.

The jacket enclosing the insert is made of abrasion-resisting alloy steel. Two types of nozzles are available—the flange type and the screw type. Adapters can be supplied for fitting the nozzle to any type of air-blast equipment. 201

Zinc-Plating Process Utilizes Low-Cost Supply

A method of electroplating steel products with zinc which uses relatively low-cost sources of zinc instead of zinc anodes is announced by the Hanson-Van Winkle-Munning Co., Matawan, N. J.; it is known as the Hubbell-Weisberg process. A special plant is necessary to put the zinc from such sources as galvanizers' skimmings, brass foundry fume, and organic reduction residues or ore into a solution of ammonium-chloride and ammonia. In use, the plating operation reduces the zinc content of the plating solution, which is then returned to the leaching plant, where zinc is again added to it. The process is stated to be economical when about 1 1/2 to 2 1/2 tons of zinc are utilized every twenty-four hours, depending upon the cost of zinc materials available.

The process is claimed to produce zinc-coated wire or strip equivalent to that produced by other plating methods. The steel handling, pickling, and cleaning are the same as in other processes. The plating tank used is especially designed to take advantage of the fact that the insoluble graphite anodes utilized seldom have to be changed. A cover is also provided which prevents the escape of ammonia fumes, while permitting rethreading of wires..... 202

Lubricant Facilitates Machining of Non-Ferrous Metals

Quaker A.M. Base No. 11 is a lubricant recently developed by the Quaker Chemical Products Corporation, Conshohocken, Pa., for use as a coolant in cutting operations on aluminum, zinc, magnesium, and their alloys. The product is a clear claret-colored oil which can be mixed as a base with kerosene. For difficult machining jobs on aluminum, about one part of the compound to three to six parts of kerosene is used. For the average machining job on aluminum or any type of die-casting, the proportions are one part of the compound to ten to twenty parts of kerosene. 203

Penetrating Agent Replaces Chlorinated Solvents

An improved wetting and emulsifying agent, known as "Dresinate," for use in conjunction with all types of alkaline metal cleaners has been developed by the Hercules Powder Co., Inc., Wilmington, Del. This new material assists aqueous alkaline solutions in certain applications to replace some of the chlorinated solvents, now scarce because of the shortage of chlorine.

The penetrant, a finely divided, uniform powder, is available in practically unlimited quantities, and is suggested for use in conjunction with trisodium phosphate, sodium metasilicate, caustic soda, soda ash, borax, and other alkaline detergents for cleaning metal prior to rustproofing, lacquering, painting, or plating.

To obtain additional information about materials described on this page, see lower part of page 162.

Research work carried on at the Hercules Experiment Station indicates that the material is suitable for all metal cleaning operations where an alkali cleaner is used to remove grease, oils, soil, and organic materials.

The addition of 3 to 15 per cent "Dresinate" to an alkaline cleaning solution, while it reduces the alkalinity slightly, increases the detergency of the solution. The wetting action of "Dresinate" causes a thin film of alkaline liquid to be spread uniformly over the metal surface, wetting out oily areas equally as well as areas free from oil. The emulsifying action assists the alkaline cleaner to get the foreign material into suspension and carry it away.

The material can be mixed with alkaline cleaners without special equipment, since it is a dry powder, readily and completely soluble in water. Alkaline solutions containing the material are rapidly rinsed from metals, speeding the time required for the cleaning operation. 204

Wood Fiber Processed for Many Industrial Uses

Wood fibers which have been available basically as insulation material in the form of blanket, bat, and insulating fibers are now obtainable for industrial purposes, according to the Wood Conversion Co., St. Paul, Minn. These fibers can be made to rigid specifications as to size, quality, chemical content, and physical appearance from various types of wood or in a number of combinations. They can be chemically treated for resistance to fire or water, asphalt treated, or specially processed in accordance with manufacturers' requirements. Such fibers are available for filters, packing pads, plastics, and other purposes, as well as for insulation..205

Steel Tubing for Copper Replacement

A soft-temper steel tubing, which is copper-coated and tinned and can be used to replace copper tubing for many purposes, has been placed on the market by the Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. This tubing, known as Imperial Bundy tinned steel tubing, is said to meet the requirements of a wide range of uses, such as for gasoline and oil lines, machine tool hydraulic and lubrication lines, conduit tubing, connecting lines for oil burners, vacuum lines, refrigeration condensers, etc.

The tubing is copper-coated inside and outside and has an additional tin coating on the outside. The tin coating makes it possible to use this tubing with regular compression, high-duty and Type D fittings with the assurance of a tight, leakproof joint. The tubing can also be used with flare and inverted-flare fittings. It can be readily bent, flared, coiled, soldered, brazed, and welded.

This tubing is said to be stronger than copper tubing, and to have a higher resistance to vibration fatigue. Bursting strength ranges from 17,800 to 8700 pounds per square inch, depending on size. 206

Transparent Tenite Seamless Tubing Extruded in Continuous Lengths is Now Available for Immediate Delivery in Sizes Ranging from 3/16 to 3/4 Inch in Diameter. This New Plastic Tubing is Virtually Unbreakable and can be Readily Bent, Formed, or Curved to Fit almost Any Condition. The Ends are Easily Adjusted to Standard Flared Fittings with the Same Tools Used for Copper Tubing

To obtain additional information about materials described on this page, see lower part of page 162.

NEW TRADE LITERATURE

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 161 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the May Number of MACHINERY

Contour Sawing Machines

CONTINENTAL MACHINES, INC., 1312 S. Washington Ave., Minneapolis, Minn. Publication entitled, "DoAlls on Production," containing 78 pages of photographs showing DoAll contour sawing, filing, and polishing machines in operation on war work in arsenals, and aircraft, navy ordnance, and industrial plants. Copies available to plant engineers who plan production and to instructors in vocational schools or defense training courses. 1

Firthite Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa. Catalogue giving sizes and prices of Firthite general-purpose, sintered-carbide tools, available in ten styles for practically all normal machining requirements. Catalogue entitled "Speed War Production with Standard Firthite Tips" containing sizes and prices of Firthite new standard and non-standard sintered-carbide tool tips. 2

Micro-Processed Beryllium Copper Springs

INSTRUMENT SPECIALTIES CO., INC., Little Falls, N. J. Bulletin 4, descriptive of the advantages of the Micro-processing method of producing beryllium copper springs, among which are reduction of distortion during heat-treatment, and retention of dimensions and elastic properties to a high degree of accuracy. 3

Cleaning Handbook

MAGNUS CHEMICAL CO., 48 South Ave., Garwood, N. J. Cleaning handbook entitled "Metal Cleaning in Wartime," containing fifty pages discussing in detail the metal cleaning problems involved in the production of shells, shell cases, fuses, and other munitions, ordnance, transport equipment, etc. Cleaning in maintenance and repair shops is also covered. 4

Metal-Cutting Saws

E. C. ATKINS & CO., 416 S. Illinois St., Indianapolis, Ind. "Guide to Metal-Cutting Efficiency," describing the latest types of Atkins metal-cutting saws, and giving recommendations for selecting the proper type of saw for cutting various materials, as well as speed and feed data and other information of value to operators of saws. 5

Radial-Arm Drills and Routers

ONSRUD MACHINE WORKS, INC., 3940 Palmer St., Chicago, Ill. Booklet entitled "Tricks and Tips on Radial Arm Drilling and Routing," comprising virtually a handbook on the operation of radial-arm drills and radial-arm routers, of value to operators, shop superintendents, maintenance men, and templet and pattern makers. 6

Gage Design Standards

LINCOLN PARK TOOL & GAGE CO., Lincoln Park, Mich. 16-page book on American gage design standards, containing material compiled from information published by the National Bureau of Standards, essentially of interest to inspection men and engineers. Copies will be sent to those making a request on a company letterhead. 7

Electric Gages

GENERAL ELECTRIC CO., Schenectady, N. Y. Booklet GES-2543, covering eleven examples of the application of electric gaging equipment—including strain gages, pressure gages, eccentricity gages, film-thickness gages, profile gages, electrolimit gages, and tensiometers. 8

Machine Tools

WILLIAM SELLERS & CO., INC., Philadelphia, Pa., is publishing a house organ known as the "Sellers Diamond," prepared by the employes and containing items of interest concerning the organization, as well as information on the part this company is playing in the war effort. 9

Refrigerated Welding

WELTRONIC CORPORATION, FROSTRODE DIVISION, 3080 E. Outer Drive, Detroit, Mich. Bulletin R-42, descriptive of the Frostrode process of refrigerated welding, developed primarily for welding jobs where water cooling is inadequate, as in welding aluminum or heavy steel sections. 10

Drop-Hammers and Presses

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., is publishing a monthly house organ known as "Ceco Sparks," prepared by the employes to better acquaint the employes with each other and with the company's policies in making an all-out effort to win the war. 11

Renewable Fuses

TRICO FUSE MFG. CO., Milwaukee, Wis. Bulletin 4500-C, contain-

ing information on how to overcome unnecessary shut-downs due to faulty fusing and poor fuse and clip contact. Bulletin 4600-OB, explaining how to prevent oil waste and shut-downs of machinery due to improper lubricating. 12

Plastic Testing Machines

TINIUS OLSEN TESTING MACHINE CO., 500 N. 12th St., Philadelphia, Pa. Bulletin 23, illustrating and describing a testing machine known as the "Plastiversal," of 50,000 pounds capacity, designed for testing plastic materials. 13

Surface Plates and Straightedges

CHALLENGE MACHINERY CO., Grand Haven, Mich. Catalogue covering precision equipment for the tool and machine industries, including lapping plates, surface plates, straightedges, parallel blocks, V-blocks, etc. 14

Portable Dust Collectors

EDWARD BLAKE CO., 634 Commonwealth Ave., Newton Centre, Mass. Leaflet illustrating and describing the "Filtaire" portable dust collector, designed to eliminate the dangers of dust-laden air, particularly in grinding and polishing operations. 15

Brass and Bronze Castings

HAMMOND BRASS WORKS, Hammond, Ind. Booklet entitled "Practical Data on Brass and Bronze Castings," containing data on copper, tin, lead, and zinc alloys, aluminum bronzes, and manganese bronzes, with chemical analysis and physical properties. 16

Ball Bearings

S K F INDUSTRIES, ATLAS BALL DIVISION, Front St. and Erie Ave., Philadelphia, Pa. Bulletin 263, entitled "How Are Balls Made Round?" describing the methods employed in producing the highly accurate balls used in ball bearings. 17

Die-Castings

DOEHLER DIE CASTING CO., 386 Fourth Avenue, New York City. Catalogue entitled "Doehler Die Castings for Victory," outlining the savings that can be made in metals, machines, and man power by the use of the die-casting process. 18

Aircraft Tools

AERO TOOL CO., 231 W. Olive Ave., Burbank, Calif. Catalogue covering this company's line of aircraft tools, including rivet sets, precision plomb bobs, dimple punches and dies, micrometer-stop countersinks, sine bars, etc. 19

Magnifier for Close Inspection

GEORGE SCHERR CO., INC., 128 Lafayette St., New York City. Folder illustrating and describing the "Magni-Ray," an instrument developed for close inspection, especially of parts entering into airplane construction. 20

Hydraulic Milling Machines

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin 0-1, describing features of the Sundstrand No. 0 hydraulic Rigidmil. The bulletin also shows examples of typical cost reducing operations performed on this machine. 21

Belt Sanders and Swing Grinding and Polishing Machines

JEFFERSON MACHINE TOOL CO., 700 W. Fourth St., Cincinnati, Ohio. Circular on an endless belt sander and on the No. 101 swing-frame grinding and polishing machine. 22

Solderless Wiring Connections

AIRCRAFT MARINE PRODUCTS, INC., 286 N. Broad St., Elizabeth, N. J. Bulletin 11, containing data on AMP Midget solderless wiring connections designed for aircraft, marine, communications, and commercial use. 23

Care of Industrial Rubber Products

B. F. GOODRICH CO., Akron, Ohio. Booklets on how to get the most service out of rubber transmission belting, conveyor belts, and V-belt drives. 24

To Obtain Copies of New Trade Literature

listed on pages 160-162 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Cleaning Solutions

L & R Mfg. Co., 54 Clinton St., Newark, N. J. Leaflet describing cleaning and rinsing solutions for cleaning aircraft instruments, meters, gages, and precision equipment of all types. 25

Gear Shaping

Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. Bulletin GS-42, containing information on the shaping of involute gears, of value to operators of gear-shaping equipment. 26

Texrope Drives

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin B6082-A, on Vari-Pitch Texrope sheaves designed to increase machine flexibility and output through quick, accurate speed changing. 27

Tap Reconditioners

Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich. Bulletin TR-42, describing the construction and operation of the Detroit tap reconditioner for increasing tap life and efficiency. 28

Carburizing Equipment

Hevi Duty Electric Co., Milwaukee, Wis. Bulletin HD-142, descriptive of the Hevi-Duty vertical gas carburizer—its construction, operating costs, uses, and advantages. 29

Blueprint Equipment

Paragon Revolute Corporation, 77 South Ave., Rochester, N. Y. Catalogue illustrating and describing the full line of Paragon-Revolute equipment for reproducing drawings. 30

Wheel Truing

Wheel Trueing Co., 3202 W. Davison St., Detroit, Mich. Circular on the "Tru-Line Principle" of wheel dressing, a new patented method utilizing two or more diamonds. 31

Lead and Tin Products

Alpha Metal & Rolling Mills, Inc., 363 Hudson Ave., Brooklyn, N. Y. Folder describing various types of lead and tin products. A comprehensive lead-tin alloy table is included. 32

Manometers, Pressure Gages, and Flow Meters

Trimount Instrument Co., 37 W. Van Buren St., Chicago, Ill. Catalogue covering manometers, pressure gages, flow meters, liquid level indicators, etc. 33

Milling Machines

Jefferson Machine Tool Co., Fourth, Cutter, and Sweeney Sts., Cincinnati, Ohio. Bulletin on the Jefferson motor-driven "Bull-Dog" high-speed precision milling machine. 34

Welding in Machine Design

Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 80 in a series on Machine Design, describing the "Weldesigning" of a press slide. 35

Drafting Pencils

Tec Pencil Co., Beverly Hills, Calif. Circular on drafting pencils of new construction with inserted leads, and motor-driven drafting pencil pointer. 36

Copper and Brass

Revere Copper and Brass, Inc., 230 Park Ave., New York City. "Revere Weights and Data Handbook," containing tabulated data relating to copper and brass. 37

Grinding Machines

Norton Co., Worcester, Mass. Folder entitled "Plunge Cut and Traverse Jobs in the Same Cylindrical Grinder." 38

Carbide Tools

Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich. Bulletin 142, on Willey's standard carbide tools and blanks. 39

Automatic Control for Resistance Welders

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 18-343, describing automatic control for resistance welders. 40

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 163-180 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in May, 1942, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 158-159, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in May, 1942, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Libby Universal Ram Type Turret Lathe

A new universal ram type turret lathe is being introduced on the market as the International Libby No. 4 by the Libby Division of the International Machine Tool Corporation, Indianapolis, Ind. This machine is supplied complete with tools for both bar and chucking work, accommodating chucks 8, 10, and 12 inches in diameter. The collet will chuck work up to 2 inches in diameter. The swing over the ways is 20 inches, and the turning length capacity 22 inches. Special equipment available for use on this machine includes bar feed and taper and threading attachments.

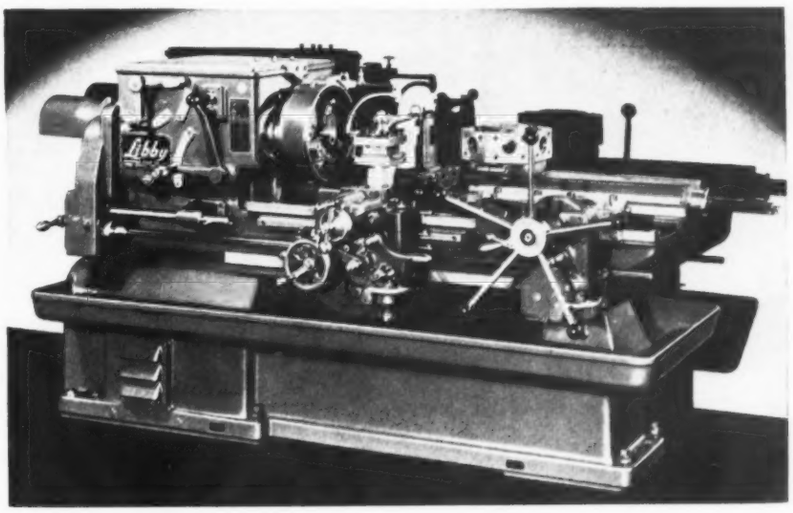
The unusually wide, hardened steel ways of this lathe are dovetailed into the cast-iron bed by a unique double-taper arrangement that holds them securely in place without the use of screws. After assembly, the hardened steel ways are ground to insure accurate alignment with the spindle.

The spindle is controlled by a single lever which operates a double, multiple-disk, main-drive clutch to obtain forward and reverse rotation. When the lever is moved to the neutral position, a multiple-disk brake is automatically applied to stop the spindle quickly. The all-geared headstock provides twelve spindle speeds, controlled by three conveniently positioned levers. When the first lever is placed in the central position, the spindle is free and can be turned easily by hand. Helical herringbone type gears are used for the high-speed drive to the spindle to obtain a smooth, uniform flow of power. The spindle is mounted in a double-row, preloaded, precision, straight roller bearing at the front end, and in a single-row, straight roller bearing at the rear, all thrust being taken by a large-diameter ball bearing at the rear. The spindle nose is the American Standard 8-inch size, Type A-1, and will take all standard chucks and fixtures. The large tapered pilot serves only to locate the chuck or fixture.

The drive is by silent-operating, multiple V-belts from a motor in the machine base. Motors of 5 or 7 1/2 H.P. are furnished, depending upon the work to be handled. These motors run at 1000 and 1200 R.P.M., respectively to give standard spindle speeds. Higher speed motors or special pulleys can be furnished to meet demands for higher spindle speeds.

The universal carriage has six reversible cross and longitudinal feeds which operate independently of the hexagon turret carriage. Quick-acting levers disengage the feed by a slight touch of the hand, or they may be set for automatic disengagement of the power feed at predetermined points. Adjustable trip-dogs are provided for the cross-slide, and a six-screw stop-roll controls the longitudinal travel of the carriage. A large micrometer dial, graduated to 0.001 inch, is provided for hand-feeding to size. The cross-slide holds the quick-indexing square turret at the front, and has three T-slots at the rear for holding the rear toolpost, which can be used for cutting-off and forming operations. The turret can be locked in any one of twelve positions.

The hexagon-turret ram-slide carriage is provided with six power feeds to the ram slide in the forward direction. The feeds are engaged by a quick-acting lever on the turret apron, which can be disengaged by hand. Automatic feed and dead stop are provided for each face of the hexagon turret by a six-screw roll stop, each screw being individually adjustable for a series of operations. The hexagon turret is automatically unclamped, indexed, and reclamped by a pilot



International Libby No. 4 Universal Ram Type Turret Lathe

To obtain additional information on equipment described on this page, see lower part of page 162.

wheel, which controls the forward and reverse movement of the ram.

Interchangeable collet pads are available for holding round bar material from 3/8 inch to 2 inches in diameter; square stock in sizes from 1/4 inch to 1 3/8 inches; and hexagonal stock from 1/4 inch to 1 3/4 inches, the variation in each successive size being 1/32 inch. The taper attachment permits turning tapers up to 2 inches per foot in lengths of 9 1/2 inches or less. 51

Bakewell Precision Radial Tapping Machine

A radial type precision tapping machine designed to permit the head to be easily and quickly swung into position for tapping holes in any desired location over a wide area has been brought out by the Bakewell Mfg. Co., 2427 E. Fourteenth St., Los Angeles, Calif. As shown in Fig. 1, the hinged type mounting of the tapping head is supported by a hydraulic ram type column. The tapping head can be raised or lowered by merely touching a button, and its free-floating feature permits it to be easily moved from one piece to another or from one hole to another in the case of large pieces that require the tapping of many holes. Large or bulky pieces can be located in pits at the side or rear of the table, since the tapping head can be swung around to cover a considerable area beyond the surface of the machine table. Vertical working tables with T-slots for clamping the work in place are provided on the end and rear of the machine.

The machine can be furnished with two hydraulic ram columns and tapping heads if desired, instead of one as shown in Fig. 1. When equipped with two heads, greater flexibility in handling large work is provided. This arrangement also permits two different pieces to be tapped simultaneously by two operators, and facilitates tapping two different sizes of holes without moving the work or changing taps.

As with previous Bakewell tapping machines, this new radial type has a patented lead-screw method of feeding the tap into the work. This is done by solenoid-actuated guide fingers in place of the usual nut arrangement. These brass fingers, shown in Fig. 2, guide the tap both on the cutting and retracting strokes by the spring pressure of the fingers on the threads of the lead-screw. A thread of the exact pitch of the lead-screw is hobbed into the brasses by contact with a fluted section of the lead-screw before the actual tapping operation is started.

During the tapping operation, the brass guide fingers are held against the lead-screw by means of the solenoid-actuated toggle linkage to permit a free-running fit and, at the same time, compensate for all wear or backlash that may be developed. This arrangement allows the tap to be led both in and out of the work in exactly the same path with the minimum possible lead error.

Another patented feature is the safety clutch, which is adjusted by the operator to the safe torsional resistance of the tap and the type of material. Classes 3 and 4 gage fit threads can be tapped on a production basis without the necessity of series tapping, regardless of the material handled. A limit control switch is provided which can be adjusted to control the depth of the tapping stroke within limits of 0.001 to 0.006 inch, depending upon the pitch used. Red and green dwell lights indicate the depth and height limits, respectively. 52

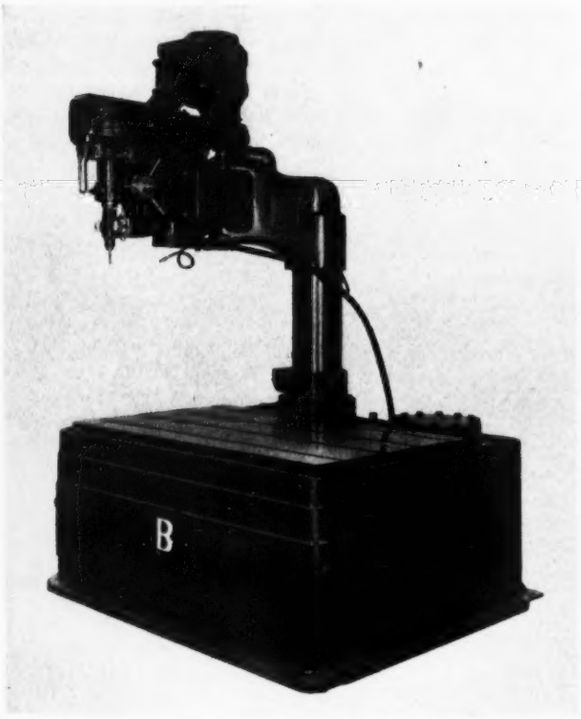


Fig. 1. Precision Radial Tapping Machine Brought out by the Bakewell Mfg. Co.

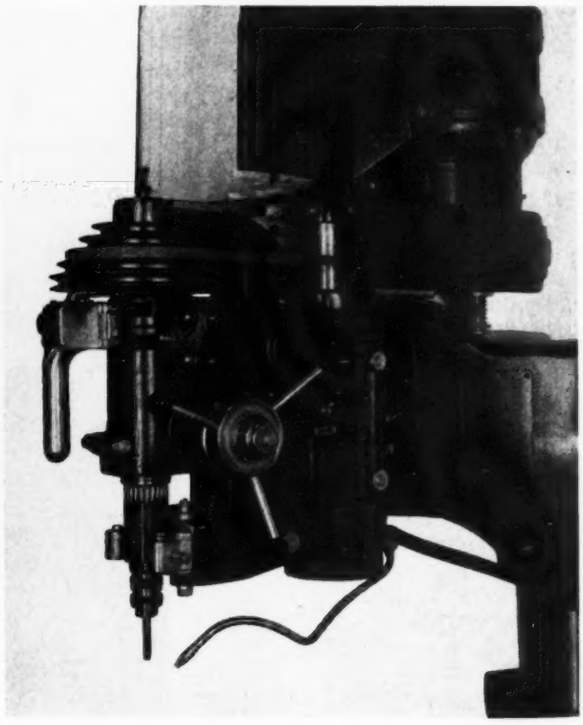


Fig. 2. Close-up View of Bakewell Tapping Head, Showing Brass Guide Fingers

To obtain additional information on equipment described on this page, see lower part of page 162.

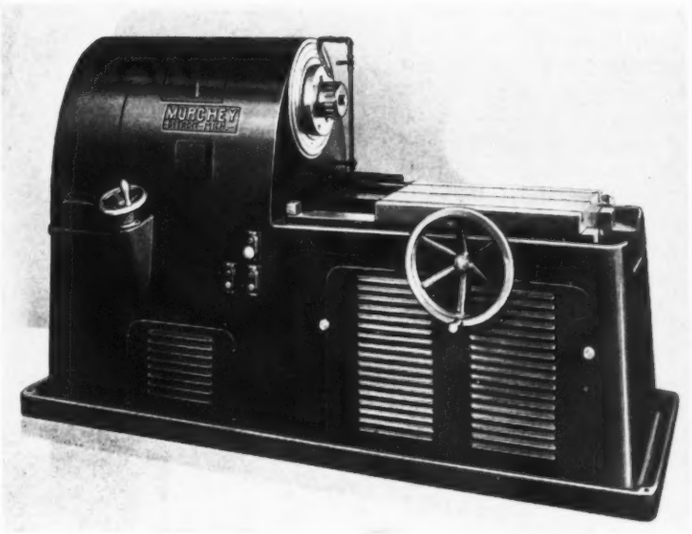


Fig. 1. Murchey Thread Milling Machine for Producing Internal or External Threads from 4 to 12 Inches in Diameter

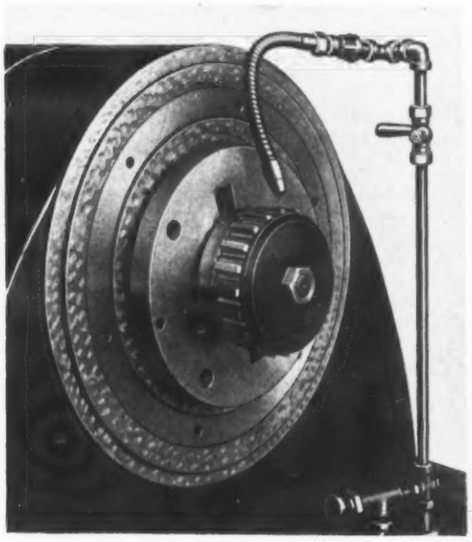


Fig. 2. Close-up View of Annular Thread Milling Cutter of Machine Shown in Fig. 1

Murchey Thread Milling Machine

A thread milling machine, designated the No. 42, has been brought out by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich., to meet the demand for equipment capable of milling threads of large diameter to close tolerances with respect to concentricity, size, and form. This machine is designed for mass production of right- or left-hand internal or external threads from 4 to 12 inches in diameter and up to 3 inches in length by means of annular milling cutters which cover the full length of the thread. The threading operation is accomplished by a completely automatic cycle, it simply being necessary to chuck the work and start the machine.

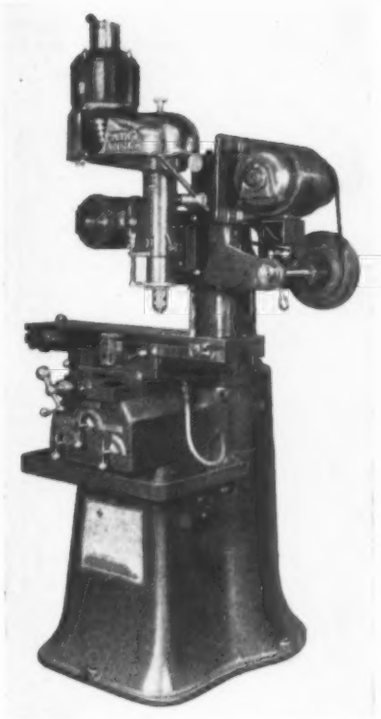
In milling a thread, the cutter, rotating on its own axis, is simultaneously revolved eccentrically about the work or piece to be threaded, while the work is held stationary, with its axis in accurate alignment with the spindle. After the milling cutter has been fed into the work far enough to produce a full-depth thread, the cutter is revolved around the work as described, while being simultaneously advanced longitudinally by means of a lead-screw. This advancing movement is continued for a sufficient distance to produce the desired helical threads.

The cutter-spindle, after completing the milling operation, automatically returns to the central position, permitting facing and counterboring operations to be performed with the assurance that they will be concentric with the thread. A hardened and ground lead-screw mounted directly on the eccentric spindle bushing and running in segmental lead-nuts insures extreme accuracy in the pitch of the thread. The depth of thread is controlled directly by adjustment of the eccentricity of the cutter-spindle.

The eccentric motion of the cutter-spindle has a range of from 0 to 3/4 inch. The cutter-spindle has a speed range of from 33 to 645 R.P.M., and makes a maximum of 1.2 revolutions around the work during each thread-milling cycle. The machine requires a floor space 37 1/2 inches wide by 100 inches in length, is 57 inches high, and weighs approximately 9000 pounds. A spindle motor of 5 to 7 1/2 H.P., 1800 R.P.M. and a feed motor of 2 H.P. 1200 R.P.M. are employed. The semi-steel cast bed provides an enclosed space for the motors, starters, flexible pulley unit, hydraulic unit, and the lubricating and cooling systems. All controls are in the front of the machine. 53

Armor Universal Turret Milling Machine

A universal turret milling machine, claimed to have a range of flexibility not previously available in a single machine, is being placed on the market by the Aircraft Machinery Corporation, Burbank, Calif. This milling machine, with hydraulic feed, utilizes a combination of horizontal spindle and vertical spindle capable of any angular adjustment, mounted on a single rigid turret which can be rotated a full 360 degrees. This arrangement is designed for use in the



Universal Turret Milling Machine Brought out by the Aircraft Machinery Corporation

To obtain additional information on equipment described on this page, see lower part of page 162.

tool-room, pattern shop, and experimental laboratory, as well as for general production work.

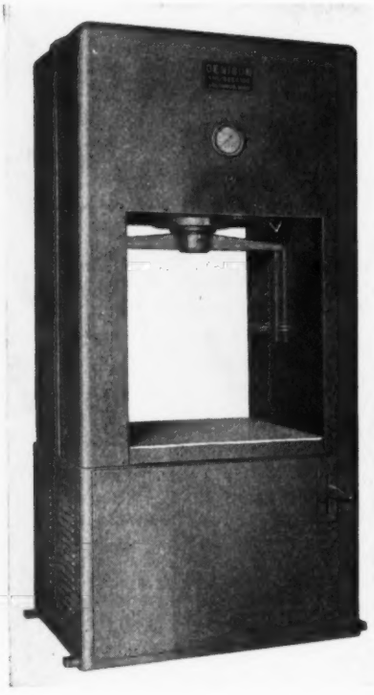
The hydraulic feed of the longitudinal table is designed to give smooth power movement for deep cuts, while hydraulic valves provide metered feed and rapid traverse in either direction for production milling. Micrometer stops guard against over-runs, and hydraulic relief devices protect the cutters from breakage or undue strain. These features make the machine particularly well adapted for use by inexperienced operators.

The longitudinal travel can be quickly and easily converted from hydraulic to hand-feed operation by means of two simple levers without disturbing the work. This conversion is especially suited for tool-room and experimental purposes. 54

Denison Hydraulic Press

A versatile "oil hydraulic" press, known as the Model DLOS2 "HydrOILic" press, has been brought out in capacities of fifty tons and up by the Denison Engineering Co., 1152 Dublin Road, Columbus, Ohio. This press is adapted for a wide range of straightening, assembling, and pressing operations in either small-lot or production work. It is of rugged construction, self-contained, streamlined, and free from projecting members. The safety factor has been given considerable attention in locating the controls. The electrical control, for example, is equipped with two operating push-buttons that require the use of both hands simultaneously. The press will continue to exert pressure until these push-buttons are released, when the ram will return to its normal position. The press ram is threaded internally to provide for attaching assembling, bending, or straightening tools.

The ram and cylinder head assembly is located in the top part of the box frame, while the control valve and its operating mechanism, the motor, pumps, tonnage controls, and oil reservoir are in the base of the press. The hand-lever and electrical controls are also located in the base of the press, and the control is so arranged that the tonnage applied to the work is controlled within reasonable limits by the operator, in accordance with the requirements of the work.....55

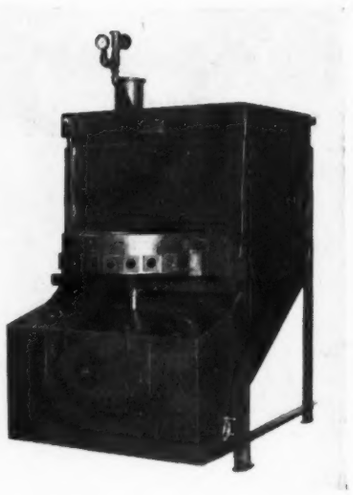


Denison "HydrOILic" Press

Rubber Abrasive Polishing Pad for Filing Tool

The H & H Research Co., 12540 Twelfth St., Detroit, Mich., has recently added a polishing pad to the line of accessories manufactured for use with this company's reciprocating-action, portable, electric filing tools. The new accessory consists of a rubber pad impregnated with abrasive, and formed in any size up to 3 inches long by 1 inch square. This pad is mounted on a holder having a 2-inch offset for use with the Senior Model tools. It can be ordered in grits ranging from 80 to 180, and in various shapes within the dimensions given.

The pads are used to remove the last few thousandths inch of material and to produce and maintain a mirror-like polish or finish on such work as dies, molds, etc. They can also be used to advantage for polishing aluminum parts. File scratches that are invisible to the eye are brought out clearly and removed with these pads.....56



Leiman Automatic Sand-blasting Machine

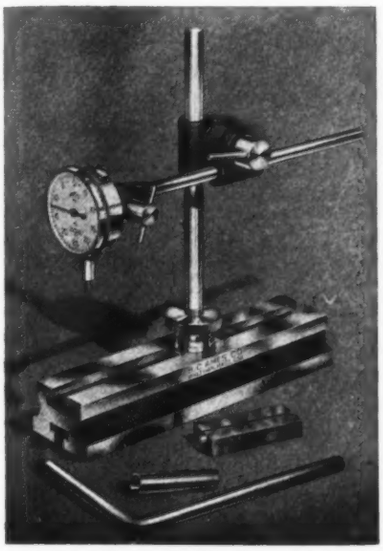
Automatic Compact Sand-Blasting Machine

An automatic sand-blasting machine equipped with a rotary table on which the work is held has been developed by Leiman Brothers, Inc., 117-4 Christie St., Newark, N. J. The table extends into the interior of the sand-blast machine, and while the outer edge of the table is being reloaded, the inside edge is under the blasting nozzles within the machine. The table is operated by a motor, which drives it at a prearranged and quickly adjustable rate of speed, so that all the parts being sand-blasted receive the full impact and cleaning effect of the sand or other materials that are being employed for the operation.

There are a number of nozzles which can be set to throw the sand in any direction desired or to concentrate it on one point. The actual sand-blast operation is carried on, of course, inside the cabinet of the machine, so that no abrasive or dust can reach the outside or affect the operator in any way.

The machine can be equipped with two or more nozzles which can be set at the proper angles to insure sand-blasting the entire area of the work. After the sand is blown through the nozzles, it quickly drops to a hopper in the bottom of the machine to be used over again. Thus there is a continuous flow of sand or abrasive. Almost any kind of work or parts made of steel, glass, Bakelite, or other materials can be handled. 57

To obtain additional information on equipment described on this page, see lower part of page 162.



Dial Test Indicator Made by the B. C. Ames Co.

Ames Dial Test Indicator

A dial indicator testing outfit developed especially for machinists, toolmakers, inspectors, scrapers, and assemblers has been added to the line of the B. C. Ames Co., Waltham, Mass. This indicator is designed for determining the flatness of surfaces, roundness and trueness of revolving parts, relative heights and thicknesses, etc. It is adjustable to any position, properly proportioned for easy handling, and built to provide rigid support for the indicator.

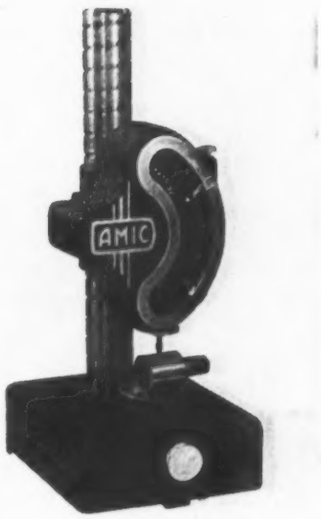
The base is 8 1/2 inches long, 2 1/4 inches wide, and is made of cast iron, accurately ground on the top and bottom. The upright rod is 5/8 inch in diameter and held along the 9/16-inch top T-slot by turning a knurled nut. The horizontal indicator holding rod is 3/8 inch in diameter and 9 inches long. It is adjustable to any position, and can be held securely in place by a lever type clamp. The indicator can be removed and used in lathes with the toolpost clamp seen in the illustration. The offset rod, toolpost clamp, lever style clamp, and horizontal indicator rod can also be used together, the adapter bushing being employed for larger holes in the lever clamp.

The indicator regularly furnished is an Ames 203, with a 1/4-inch spindle travel, graduated in thousandths and half-thousandths. Any indicator having a rear clamping lug with a 1/4-inch hole can be used. 58

Amic Comparator

Errors in size as small as 0.00002 inch are said to be easily detected with the Amic comparator manufactured by the American Measuring Instruments Corporation, 40 W. 22nd St., New York City. This comparator is built with watch-like precision, and has a magnification of 1:1000, a difference in size of 0.001 inch in the part being inspected causing a movement of 1 inch on the indicator dial. Each inch space on the dial is divided into ten spaces, so that each division represents 0.0001 inch. The measuring capacity covers a range of plus or minus 0.003 inch. The working height capacity is 12 inches, the throat depth 4 inches, and the working circle obtained by swiveling the head 10 inches.

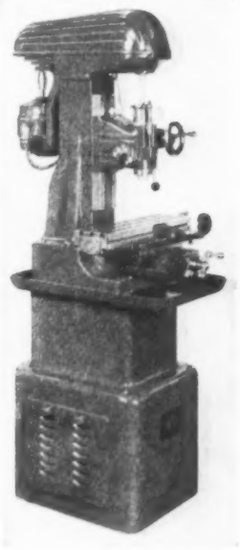
A lever on the outside of the housing raises the contact pin to facilitate insertion of the part to be gaged, and serves to eliminate shock to the mechanism and prevent premature wear of the contact pin. Two sliders at the front plate of the instrument control the positions of the limits. The base is 6 by 8 1/2 inches. 59



Comparator Made by American Measuring Instruments Corpn.

Improved Vernon Vertical Jig Borer and Horizontal Milling Machine

Improvements in design and construction have been incorporated in the Vernon vertical milling machine and jig borer made by the Machinery Mfg. Co., 1915 E. 51st St., Vernon, Los Angeles, Calif. In addition to closer over-all tolerances in construction, improvements in rigidity and operating accuracy have been made in the latest models. The 6-inch by 21-inch table has been redesigned for greater rigidity, as have the column, knee, and pedestal. Micrometer depth stops have been improved to provide even greater accuracy when drilling or boring to predetermined depths. Gib locks, independent quill lock, and longitudinal table stop have all been improved. A larger chip pan is included on the cast-iron base. The motor brackets have been changed to accommodate a greater variety of motors.



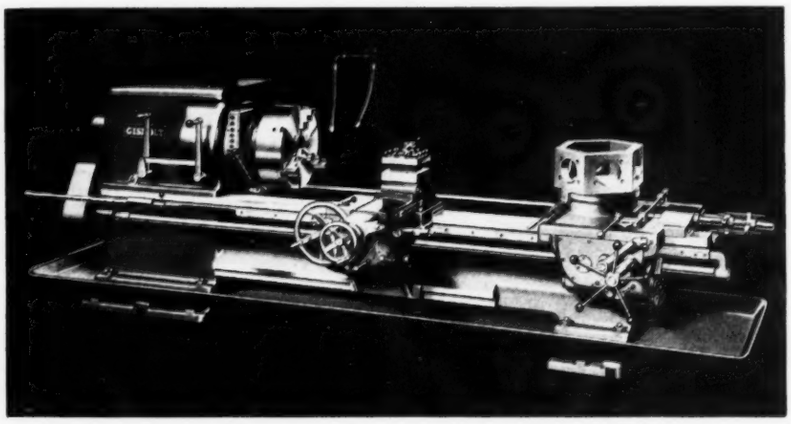
Improved Vernon Vertical Jig Boring Machine

The Vernon No. 0 horizontal milling machine which was described in the November, 1941, number of MACHINERY, has also undergone improvements in design, construction, and operating controls. Improvements in the bearing assemblies include labyrinth housings for the spindle bearings in place of the oil seals formerly used. Double rows of bearings on cross and longitudinal lead-screws replace the single row used in former models.

Power transmission has been improved with accurately balanced spindle driving pulleys of increased size. Keyways in both the driver and driven pulleys replace set-screws, and a more substantial power-feed bracket is now

To obtain additional information on equipment described on this page, see lower part of page 162.

equipped with two bronze bushings. Other features of the improved machine include a heavier knee, tapered gibs throughout, 2 1/2 inch additional column height, all lead-screws increased to 3/4 inch in diameter, Zerk fittings on nuts, handwheels employed in place of lead-screw cranks, over-arm length increased 4 inches, sturdier bracket with honed bore, bronze gib lock handles, new type pedestal and larger chip pan, and new motor with adjusting quadrant to accommodate 1-H.P. motor. 60



Gisholt Saddle Type Turret Lathe Built in Two Sizes

"Vari-Typer" Machine for Lettering Drawings

The instructions, notes, dimensions, bills of materials, etc., ordinarily hand-lettered on drawings by the draftsman can now be quickly typed by a stenographer using the "Vari-Typer" machine recently brought out by the Ralph C. Coxhead Corporation, 333 Sixth Ave., New York City. This engineering "composing" machine, as it is called, has an open carriage which enables it to be used for lettering and dimensioning tracings as large as 8 feet wide by 20 feet long. Changeable type fonts permit the use of a variety of styles and sizes of alphabets or type. The spacing arrangement also permits the use of alphabets with letters of different widths. It is claimed that a hand-lettering job requiring from four to five days of the draftsman's time can now be typed in half a day on a "Vari-Typer." 61

Gisholt Saddle Type Turret Lathes

The Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis., is bringing out two new saddle type turret lathes designated the 3R and 4R. These turret lathes are similar to the 3L and 4L machines, but the new machines have been designed for large-scale production, and must necessarily be built from materials that are obtainable in large quantities. Each machine will be provided with the most commonly used tools and attachments. The 3R machine will have a 5 1/4-inch spindle bore; 21-inch chuck; 28 1/2-inch swing over the ways; 26-inch swing over the carriage wing; and 21 1/2-inch swing over the cross-slide.

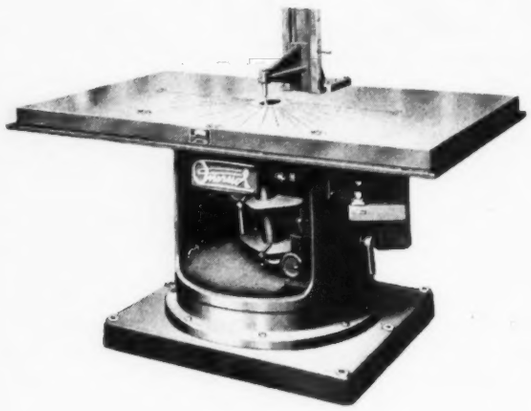
The 4R machine will have a 9 1/4-inch spindle bore; 24-inch chuck; 31-inch swing over the ways; and 27 1/2-inch swing over the carriage wing. 62

Onsrud Tilting-Spindle Shaper

A tilting-spindle shaper designed to cut a bevel of varying angle on form blocks used in hydraulic press work, and to perform a variety of operations required in machining non-ferrous metals and their alloys, plastics, wood, and composition materials in tool-rooms and pattern shops, as well as on regular production lines, has been brought out by the Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

Production work can be machined to closed or open angles up to 20 degrees simply by tilting the spindle and cutter to the angle de-

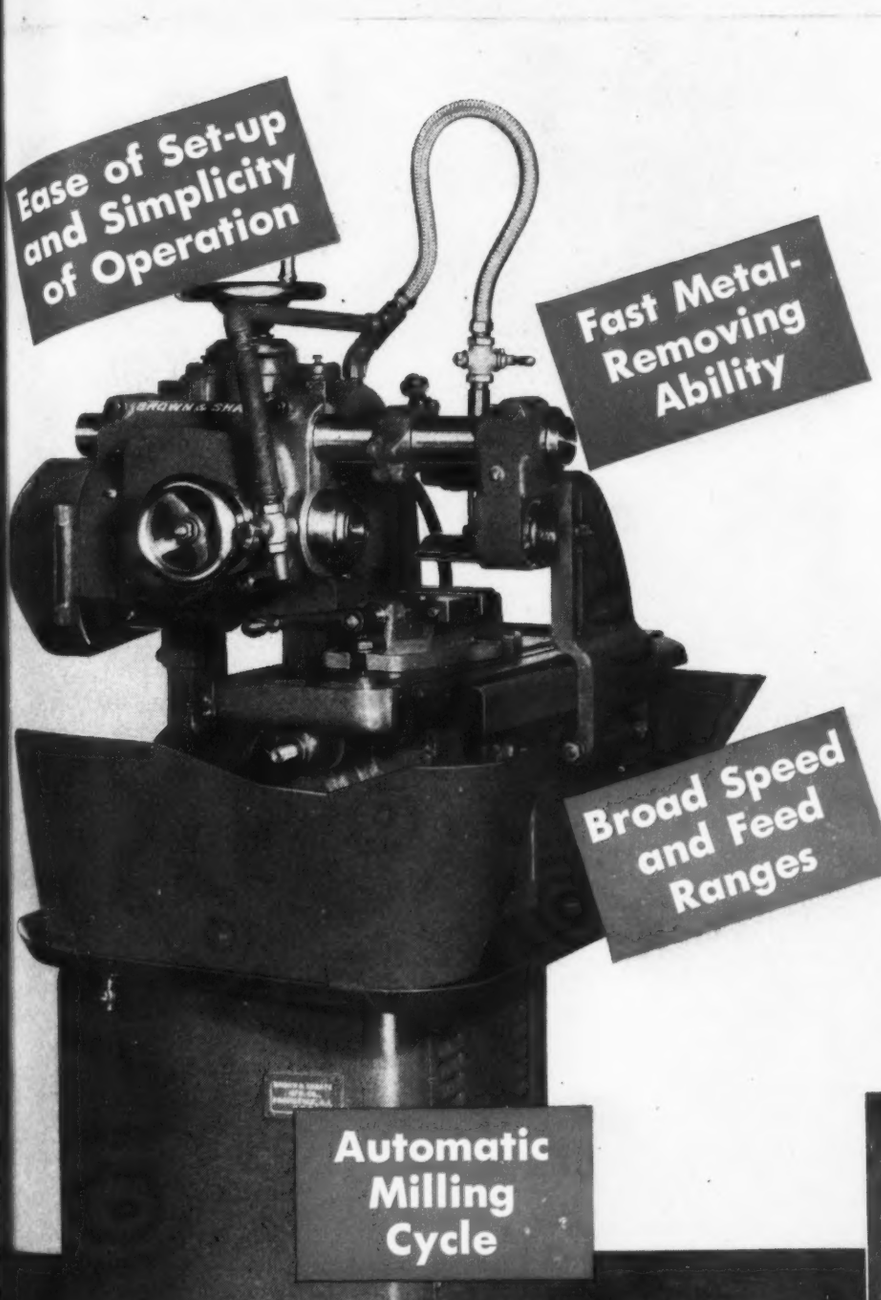
"Vari-Typer" Developed for Lettering and Dimensioning Drawings

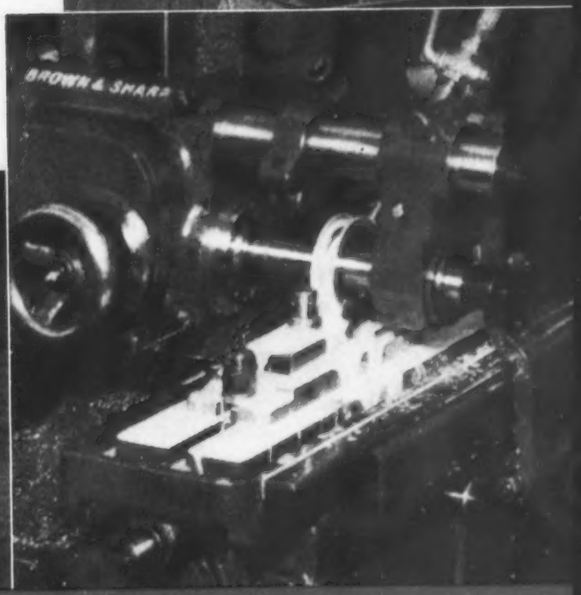


Onsrud Tilting-spindle Shaper for Cutting a Bevel of Varying Angle

To obtain additional information on equipment described on this page, see lower part of page 162.

No. 000 — *Exceedingly* Productive on milling of small work, in a variety of materials


Ease of Set-up and Simplicity of Operation
Fast Metal-Removing Ability
Broad Speed and Feed Ranges
Automatic Milling Cycle



DOES YOUR WORK COME WITHIN THE CAPACITY OF THE No. 000 PLAIN MILLING MACHINE? — Longitudinal Power Movement of Table, 6". Maximum Length of Cutting Feed, 5½". Transverse Adjustment of Spindle, 2". Vertical Adjustment of Spindle Head, 5½".

E

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.

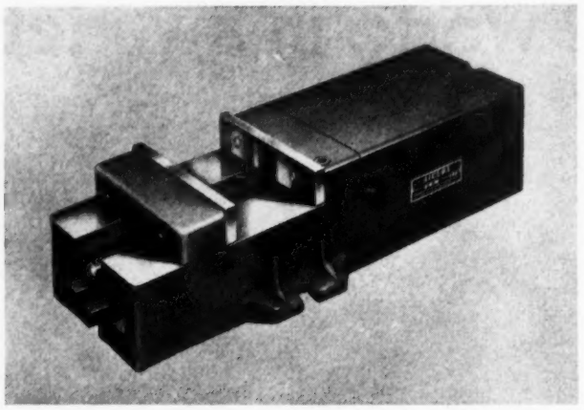
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

BS

BROWN & SHARPE

sired. A fence or similar fixture is used as a guide, the work being fed past the cutter by hand. The sweep feed can be easily understood by bearing in mind that the bevel or plane machined on the work results not only from the angle at which the cutter is tilted, but also from the direction in which the work is fed across the cutter. A high-cycle motor drives the cutter directly at a speed of 10,800 R.P.M.

Since the spindle can be set at a particular angle and the graduated table surface can be used as a visual guide for feeding the work in a particular direction in relation to the cutter, it is a simple matter to machine the work to the required angle or bevel. As the direction of feed is changed, the bevel being machined is also changed, and in this way, a sweep feed can be employed to obtain a varying bevel. The bevel angles resulting from the many combinations of tilted spindle and direction of feed are tabulated, and from this data an operator can easily obtain the constant or varying bevel desired.....63



Quick-acting Pneumatic Vise Developed by Production Devices, Inc.

Airlox Senior Pneumatic Vise

A quick-acting, air-operated vise developed to insure a positive grip on the work has been brought out by Production Devices, Inc., 1169 Main St., East Hartford, Conn. The new vise has a single-acting air piston operating through a leverage mechanism to provide the movable jaw with sufficient clamping power to meet all work-holding requirements. Through the use of an inexpensive tripping valve, production can be speeded up by synchronizing the opening and closing movements of the vise with the movement of the machine members. Spring jigs and special jaws can be used in conjunction with foot, hand, cam, air, or electrically operated valves to speed up milling, planing, broaching, drilling, tapping, assembling, and bench operations.

Special features include a completely enclosed mechanism, which assures freedom from dirt, chips, coolants, etc.; instantly adjustable jaw; ground jaw faces with holes spaced to suit work if desired.

The length of the vise is 22 5/8 inches, the width 8 1/2 inches, height 5 inches, and weight 75 pounds. The jaws are 7 inches wide and 1 1/2 inches deep. The movable jaw has a travel of 1/2 inch, and there is a maximum opening of 7 inches between the jaw castings. The maximum air consumption is 0.02 cubic feet per operation, and the gripping force fifty times the air-line pressure.....64

Device for Inspecting Small Parts

Designers for Industry, Inc., Terminal Tower, Cleveland, Ohio, have placed on the market an improved machine for inspecting parts by superimposing images or composite images of the objects or gages to be compared in a clear, distinct manner. The device employs a pair of lenses surrounded by spiral coils of gaseous discharge tubes and means for successively energizing these tubes in alternate relation with respect to each other at a sufficiently rapid rate to cause the image projected by each lens to persist as a continuous image.

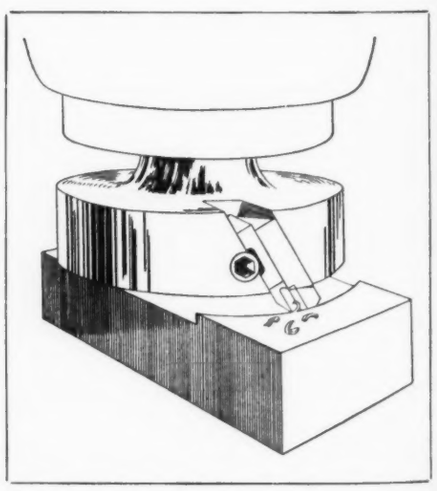
When used with a screen, the image of the master part or gage can be thrown directly on the screen in one color, while the image of the part to be compared with the master part can be superimposed in a contrasting color. Any differences in width, length, or depth of the part inspected, as compared with the master part or gage, will be measured by the graduations on the adjusting knobs.

The device, when equipped with automatic conveyor and used in conjunction with photoelectric cells, provides for the automatic inspection of small parts and the rejection of those not exactly like the master or original part, thus solving the problem of inspecting parts produced in large quantities.....65

"Kennamill" Single-Blade Cutter for Milling Operations

A single-bladed cutter known as "Kennamill," which is claimed to be capable of performing many milling operations more efficiently than conventional multiple-bladed cutters, has been developed by the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa. The new cutterheads can be made in almost any shop, and are designed to use Kennametal tools as shown in the accompanying illustration.

The tool or cutter is designed with a negative helical angle of 35 to 55 degrees and a positive hook angle of 15 to 25 degrees. It is



"Kennamill" Single-blade Milling Cutter

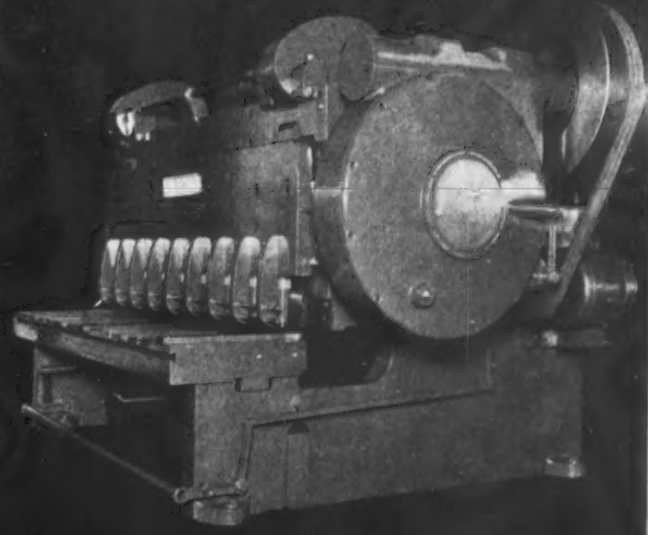
To obtain additional information on equipment described on this page, see lower part of page 162.

SHEARING ARMOR PLATE

on a Cincinnati

Armor plate is tough. Shearing it requires special application of machine . . . special knives.

Write for Recommendations on Your Job



THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

claimed that the efficiency of this cutter in milling steel is due to the fact that Kennametal does not gall or permit the adherence of steel chips to the hard tool tip.

For roughing cuts up to 3/8 inch deep, a 35-degree negative helical angle and a 15-degree positive hook angle on a 12-inch diameter cutterhead have been found satisfactory. For light finishing cuts, a negative helical angle of 55 degrees, with a 20-degree positive hook angle, is most efficient.

Kennametal cutters should be run at a peripheral speed of 300 to 600 feet per minute, with a table feed of 0.008 inch per revolution, depending on the material machined. A head 6 inches in diameter will permit a table feed of about 6 inches per minute and a speed of 380 R.P.M., or the equivalent of 600 cutting feet per minute. Clearances should be kept to a minimum, and only a slight radius should be used. No coolant should be employed, as it is impossible to keep the cutting point flooded at the high speeds used. 66

Olsen Universal Testing Machine for Plastic Materials

A universal tension-compression and flexure testing machine of 50,000 pounds capacity, known as the "Plastiversal," has just been added to the line of testing machines built by the Tinius Olsen Testing Machine Co., 530 N. Twelfth St., Philadelphia, Pa. This machine is designed especially for the varied and exacting requirements of the plastics industry. With this compact unit, precision tests can be made in tension or flexure on film, sheet, or molded specimens. Thick plates, blocks, or other objects can be tested by heavy loads in flexure or compression. Ample working clearance and long stroke, with testing speeds variable over a wide range, are features of this machine.

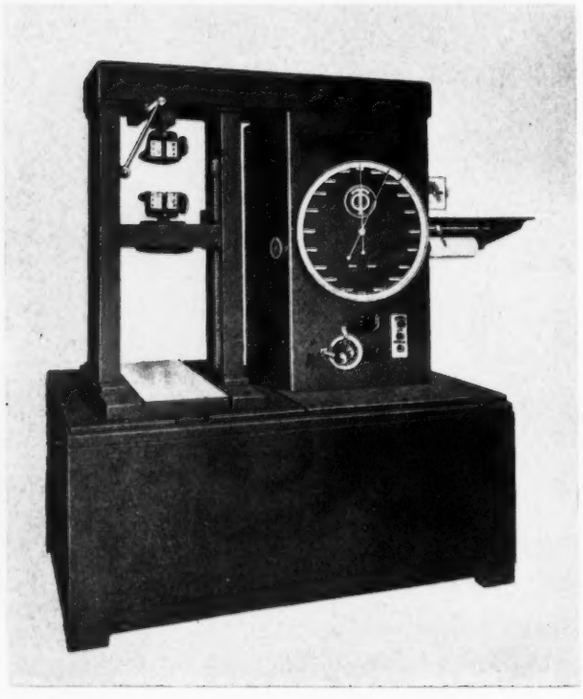
The machine is practically noiseless in operation. The working clearance between columns is 17 1/2 inches, and the stroke, starting with 4 inches between tension grips, is 24 inches. The maximum height of compression specimens accommodated is 28 inches. The compression table is 13 inches wide and 17 inches deep. The machine has a depth of 27 inches, a width of 6 feet 3 inches, and weighs 4000 pounds. 67

Federal Press Equipped with Multiple Dial Feed

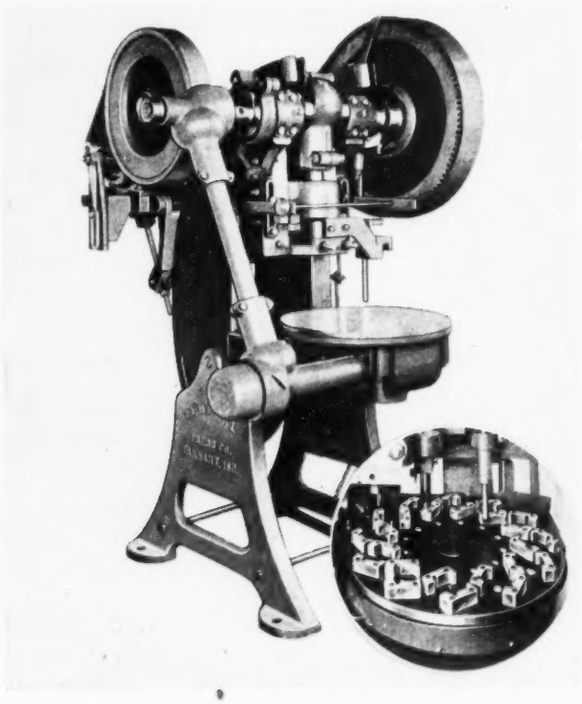
A press equipped with multiple dial feed has been added to the line of the Federal Press Co., Elkhart, Ind. The positive indexing and locking mechanism of the dial feed is designed to permit unusually high operating speeds with accuracy and safety. All moving parts of the feed are enclosed, except the dial plate itself, so that there is no possibility of injury to the operator.

Indexing is obtained positively and accurately by a cam and gear arrangement in connection with the crankshaft. This specially developed cam smooths out the indexing motion to facilitate speed. The cam allows the dial to be indexed any part of a revolution of the crankshaft from 90 to 180 degrees; thus, a long or a short dwell of the dial is obtained, as necessary, to allow the operator whatever time is required for placing the work in the fixture in the dial station. Automatic loading and ejector mechanisms can be furnished where even greater speed is desired.

This press can be adapted to handle a great variety of secondary operations. The simple design and positive action of the dial feed permits a wide range of tooling for hundreds of different jobs. Dial



Olsen "Plastiversal," Designed for Testing Plastics



Federal Inclinable Press with Multiple Dial Feed

To obtain additional information on equipment described on this page, see lower part of page 162.

CINCINNATI BICKFORD DEFENSE ACCOMPLISHMENTS···
. . . this battery of
SUPER SERVICE RADIALS
is speeding Warner & Swasey
Turret Lathe Production!
• It takes machine tools to make machine tools . . . and here in the plant of Warner & Swasey, it's a battery of Cincinnati Bickford Super Service Radials helping to turn out W & S Turret Lathes in an ever increasing stream. To bring defense production to a peak, Warner & Swasey is working 24 hours a day, 7 days a week . . . and these Super Service Radials are on the job all the time, and doing a job all the time!
On this particular unit, the job consists of drilling, reaming and finish boring of a W & S multiple turning head casting . . . the hole is 2½" in diameter . . . four holes are completed, plus a chamfer operation, before the piece leaves this machine.
Here, then, is another phase of Cincinnati Bickford's all-out effort in behalf of defense. Like all other machine tool manufacturers, Cincinnati Bickford realizes its responsibility . . . hand in hand cooperation is the watchword. Wherever rapid, low cost, high precision and quality work is demanded, there you'll find Cincinnati Bickford Super Service Radials, serving in a saving and satisfactory way.
SUPER SERVICE
THE CINCINNATI BICKFORD TOOL CO.
OAKLEY · CINCINNATI · OHIO · U. S. A.

feeds are available on eight sizes of presses ranging in capacity from 6 to 80 tons. Dial plates on the Nos. 0, 1, and 2 presses have ten stations, while those on presses 3, 4, 5, 6, and 7 have twelve.

A new safety lock feature makes it possible to set or adjust the dies while the flywheel is in operation. The incline adjustment, operated from the front of the press, insures easy and safe operation. The flywheel bearings are Timken equipped. The bearing caps are split vertically, and rest on the reinforced frame, thus transmitting shock from the thrust and return strokes directly to the frame. 68

Taft-Peirce Rotary Surface Grinder

A 6-inch rotary surface grinder in which new principles of design are incorporated has been introduced on the market by the Taft-Peirce Mfg. Co., Woonsocket, R. I. The outstanding feature of this machine is its ability to produce surfaces that are flat within very close limits of accuracy. A tilting wheel-head adapts the machine for difficult shoulder work. Almost no effort is required for its operation. Long life is assured by the hardened and ground ways and the ball-bearing equipment for the traverse arrangement of the saddle and column.

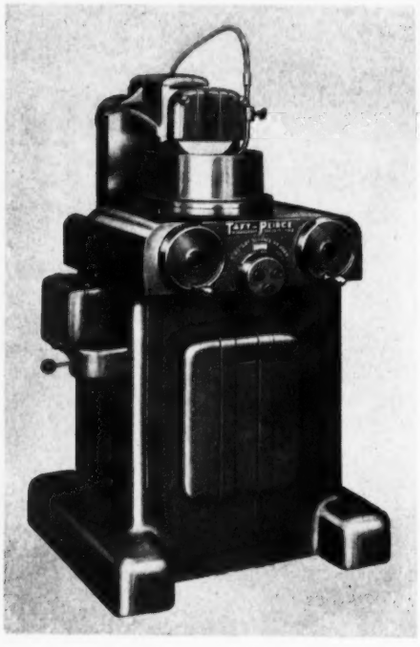
The wheel-spindle swivels in a vertical plane about the center of the wheel. The spindle is carried between two pairs of circular dovetail slides, which permits the entire spindle to be swiveled about the wheel center from the horizontal position through an angle of 30 degrees below center. The ball-bearing, quill type wheel-spindle is driven directly from a 1-H.P., 3600-R.P.M. motor. The motor is controlled by a toggle switch. The spindle, being a complete and self-contained unit, is readily removable.

The work-spindle is driven through a worm-and-gear reduction from a 1/4-H.P. motor mounted on the base of the spindle housing. The magnetic chuck is of special design, with a work surface 6 inches in diameter, and permits holding very small pieces of work in the center of the faceplate. The handwheel at the right operates the elevating mechanism by means of a telescoping shaft and gearing to the elevating screw which rotates in the bronze column nut. The large dial is graduated to 0.0005 inch with the graduations approximately 3/16 inch apart, making possible accurate reading and setting.

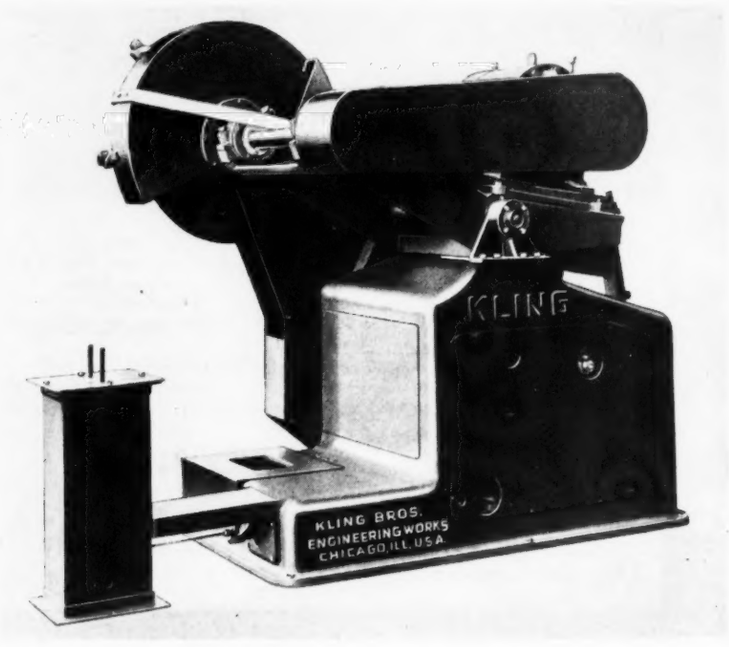
Oil is supplied to all points requiring lubrication, except the wheel-spindle and grease-sealed bearings, by means of a one-shot system located in the pedestal. The height of the work-chuck above the floor is 40 inches, and the height under the wheel is 12 inches. The cross-travel of the saddle is 4 inches, and the vertical travel of the wheel-head 12 inches or 0.050 inch per revolution of the handwheel. The grinding wheel is 7 inches in diameter, 1/2 inch thick, and has a 1 1/4-inch hole. 69

Kling Down-Stroke Friction Saws

Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill., has brought out a 36-inch and a 48-inch down-stroke friction saw for cutting solid or hollow, hot or cold steel stock. These saws are equipped with hydraulic feed, and are supplied with main motors of 40 to 75 H.P. Both units are ruggedly built for constant heavy-duty service. The important features of these machines include high rim speeds, simplicity of saw-changing operations, constant parallel plane



Taft-Peirce Rotary Surface Grinder with Tilting Wheel-head



Friction Type Cutting-off Saw Made by Kling Brothers Engineering Works

To obtain additional information on equipment described on this page, see lower part of page 162.

THIS SOUND MEANS VICTORY

The whirring of pulleys and belts . . . the meshing of gears . . . the hum of mechanical power producing war material on an unparalleled scale . . . in practically every factory in the United States . . . 'round all the hours of the clock—

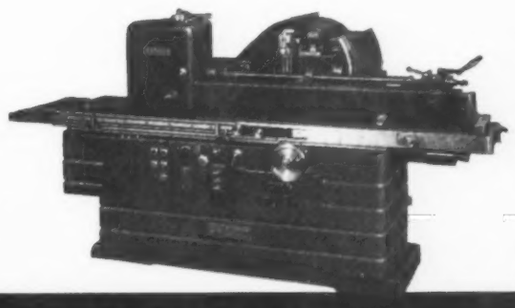
—this is the real battle cry of American industry . . . employees and employers together . . . as it lines up on the vast production front—

—a sure sound of Victory!

It has long been the predominant sound in all of the plants of Ex-Cell-O Corporation, where, day and night, thousands of skilled workers . . . loyal soldiers in overalls . . . are producing precision machine tools, cutting tools, precision-made parts, all in aid of this country's vital war effort.

EX-CELL-O CORPORATION • DETROIT

Below: Ex-Cell-O Precision Thread Grinder—Style 35-L . . . one of nine standard machines being widely used to produce highly accurate threads on hardened metal parts for the aircraft and other industries.



XLO

EX-CELL-O *means* PRECISION

★ *Precision* THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

of saw rotation, and elimination of end motion in the swing frame.

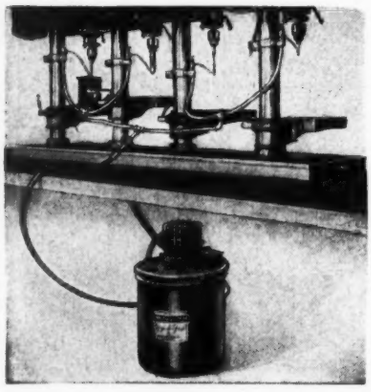
The swing frame is actuated by means of a double-acting hydraulic cylinder through a 1 1/2-H.P. motor and pump which delivers oil at constant pressure during the cut and at low pressure while idling between cuts. The operating pressure is adjustable to provide the necessary load on the main motor, which remains uniform during the entire cut. The rate of the down stroke of the saw blade is adjustable up to 2.8 inches per second, while the up stroke is fixed at 4.35 inches per second.

The saw blade is shielded with a fabricated hood, and a cooling system is provided for directing water on the blade. 70

Gray Portable Controlled-Flow Coolant Pumps

Two portable, controlled-flow, coolant pumps designed for easy attachment to drill presses, lathes, grinders, saws, tapping machines, milling machines, etc., are being placed on the market by the Gray-Mills Co., Inc., 213 W. Ontario St., Chicago, Ill. These new pumps are designated G-2 and G-3, and have capacities of 75 and 130 gallons per hour with pressures of 20 and 30 pounds, respectively.

The features of the new models are portability, control of coolant flow from small stream to full flow adjusted by a simple wing-nut, capacity to withstand continuous operation, easy replacement of worn parts, ability to handle coolants within a wide viscosity range, easily cleaned strainers, low first cost, and low operating cost. ... 71



Coolant Pump Applied to Four-spindle Bench Drill

Heavy-Duty Drill for Aircraft Work

The United States Electrical Tool Co., Cincinnati, Ohio, has just placed on the market a heavy-duty "Aircraft Special" ball-bearing portable drill. As its name denotes, this drill is designed primarily for operations in the aircraft industry and other industries having similar construction or production work. This new Model 14ARD, 1/4-inch drill has a universal motor with speeds ranging from 750 to 5000 R.P.M.

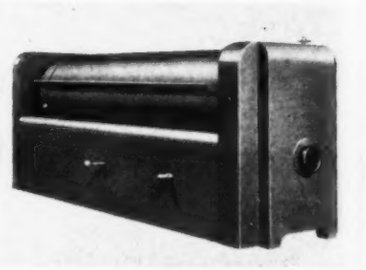
The ball bearings are set in steel retainers with screw plugs to permit easy removal. A locking pin in the center of the trigger switch permits the drill to be used by either a right- or a left-handed operator. Streamline construction has eliminated projecting members, and the close coupling permits use of the drill in cramped quarters. 72

Drill for Aircraft Work Made by the United States Electrical Tool Co.

Pease Dark-Room Printer

A dark-room printer especially adapted for table use has just been brought out by the C. F. Pease Co., 2622 W. Irving Park Road, Chicago, Ill. This new printer—the Model D-3—has been developed to provide positive contact, accurate light control, adequate speed for all dark-room printing requirements, and compactness, combined with durability.

The contact glass is approximately 9 inches deep, and is slightly curved to insure proper contact.



Dark-room Printer Made by C. F. Pease Co.

The contact band, of the endless chain type, is made of black, specially woven, two-ply, seamless fabric. The light source consists of two 40-watt white fluorescent tubes which have a total current consumption of approximately 5 amperes. Since practically no heat is developed in the tubes, no artificial cooling is required.

The amount of printing light desired is controlled by a "clam-shell" type shutter that can be quickly closed or adjusted by means of a lever. A 1/4-H.P., variable-speed motor, with a two-speed gear shift, provides a speed range of approximately 2 inches to 3 feet per minute in low gear, and from 10 inches to 5 1/2 feet per minute in high gear.

The printer is 22 inches high, 60 inches wide, and 18 inches deep. Its weight is approximately 240 pounds. 73

General Electric Alternating-Current Reversing Starters

A new line of alternating-current combination magnetic reversing starters for full-voltage starting and reversing of squirrel-cage induction motors has been brought out by the General Electric Co., Schenectady, N. Y. These single-unit starters are suitable for the primary control of wound-rotor motors. They consist of two mechanically interlocked reversing contactors, a two-pole overload relay, and either a circuit-breaker or a fusible or non-fusible motor-circuit switch.

The starters are completely wired and ready to operate after connection of the incoming power lines, outgoing motor lines, and control circuit. The line includes NEMA sizes 0 to 4 starters covering

To obtain additional information on equipment described on this page, see lower part of page 162.

ZINC IN WAR

"Keep [illegible]thy"

It is rather ironic that zinc is used in the brass for shells that wound men—and in pharmaceuticals that heal them. Such is the futility of wars, yet such is the widespread importance of zinc when wars are thrust upon us. The use of zinc oxide in the preparation of adhesive tape, ointments and other medicinal products is one which carries an unquestioned preference rating. Pharmaceutical (U.S.P.) zinc oxide is the purest type of zinc oxide known and it is characterized by several outstanding qualities. It is protective, mildly astringent and adhesive. The exceptional fineness and whiteness of this zinc oxide make it especially suitable in ointments, dusting powders and adhesive tape.

While most of the war uses, shown in the index of this book, involve larger tonnages of zinc than U.S.P. zinc oxide, few are more important from a utility standpoint. The needs of the Medical Departments of our armed forces are just another reason why civilian users of zinc may not be able to obtain all of the metal or pigment they would like to use.

THE NEW JERSEY ZINC COMPANY

MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS

7 PHARMACEUTICALS

METAL SPRAYING

GALVANIZING

NICKEL SILVER

●

1 HULL PLATES

2 RUBBER

3 PAINT

4 BRASS

5 CERAMICS

6 DIE CASTING

New Jersey Zinc

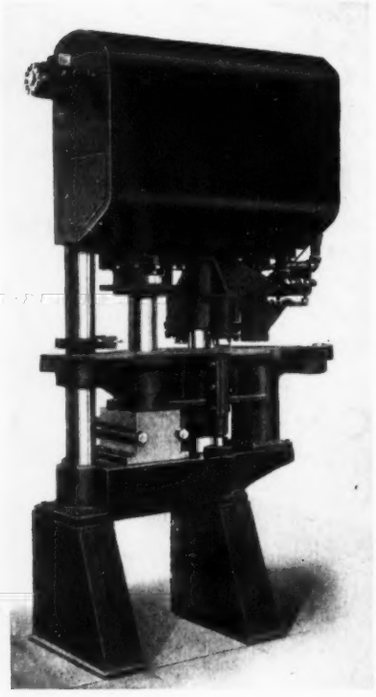
single- and three-phase motors in sizes up to and including 100 H.P. at 440 or 550 volts.

The motor-circuit switch is operated from the outside of the enclosing case by a handle which is so interlocked with the cover that the switch must be in the "off" position before the cover can be opened. The breaker can be reset after operation by returning the operating handle to the "off" position. These starters are available in general-purpose, semi dust-tight, and water-tight type enclosures. 74

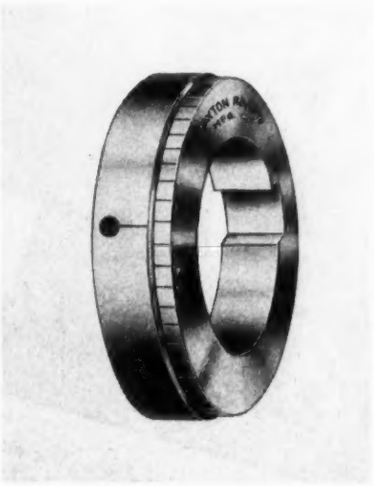
Watson-Stillman Automatic Extrusion Press

An improved 125-ton extrusion press which permits simultaneous loading and extruding has been developed by the Watson-Stillman Co., Roselle, N. J. The first of these presses was built to extrude carbon mixtures, but the press is also suitable for extruding any plastic material. It has two containers mounted on a swinging arm. The operator starts the automatic extrusion cycle by a push-button, and then devotes his attention to loading the free container. The container arm is provided with lifting cylinders to facilitate swinging it and with hold-down cylinders designed to seal the container against the die during the extrusion operation.

The main ram is 12 1/2 inches in diameter, and has a 12-inch stroke. The advance speed is 54 inches per minute, the pressing speed 6.4 inches per minute at a pressure of 2000 pounds per square inch, and the return speed 150 inches per minute. Power is furnished by two Vickers pumps driven by a 5-H.P. motor. The complete unit is 10 feet high, and requires a floor space of 4 by 3 feet. 75



Automatic Extrusion Press Built by Watson-Stillman Co.



Dayton Rogers Adjustable Spacing Collar for Milling Cutters

Dayton Rogers Adjustable Spacing Collar

The entire line of adjustable spacing collars made by the Dayton Rogers Mfg. Co., 2830 Thirteenth Ave. S., Minneapolis, Minn., has been redesigned to provide a maximum adjustment of 1/16 inch, or double the amount available on the line previously manufactured. The outside diameter and the thickness of the collars have both been reduced. This has been made possible by forging the collars from a special alloy 1023 steel and providing them with machine threads of micrometer accuracy.

These collars are now being made in eleven sizes to fit arbors from 5/8 inch to 3 inches in diameter, and are adapted for use in all kinds of gang milling set-ups. They can be used to advantage for accurate spacing of straddle-milling, gang-milling and multiple-slotting milling-machine cutter set-ups, thus automatically eliminating the necessity for using shims. The collars are graduated for adjustment in thousandths of an inch, but a setting as fine as 0.00025 inch can be easily obtained. 76

Carbide Tool Grinder Made by Standard Electrical Tool Co.

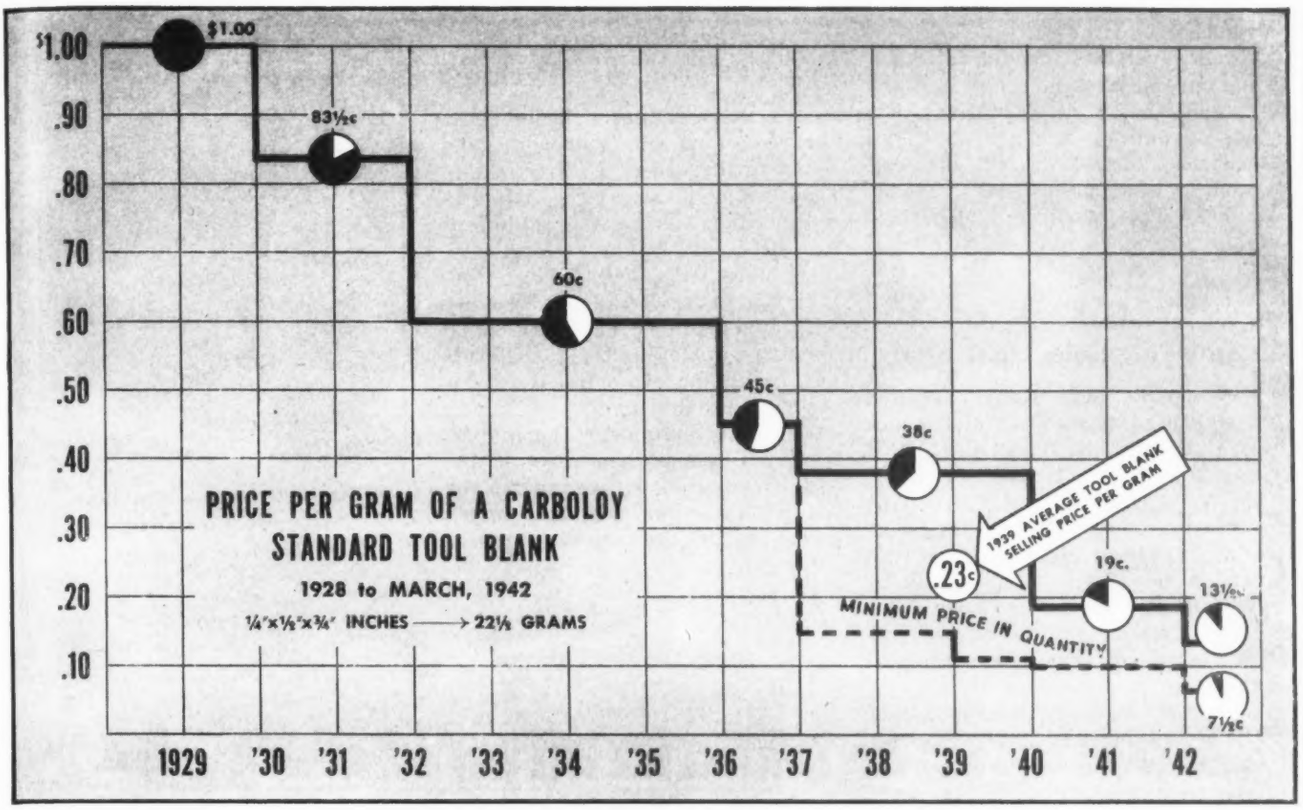
Carbide Tool Grinder

A new carbide tool grinder—Type CCGA—has been placed on the market by the Standard Electrical Tool Co., Cincinnati, Ohio. This grinder is equipped with a 3-H.P., 1150-R.P.M. motor for use with a straight grinding wheel 18 inches in diameter having a 2 1/2-inch face. Suitable flanges are also furnished to accommodate this size wheel with a 10-inch diameter hole. Since the outside diameter of the wheel flange is 15 inches, the actual amount of abrasive lost or wasted through wheel wear consists only of a ring 1 1/2 inches thick.

On the side of the spindle opposite to that on which the straight grinding wheel is mounted is a steel plate to accommodate mechanically mounted 14-inch diameter cylindrical wheels adapted for face or finish grinding. On the cylindrical or cup-wheel side there is a table provided with graduations for angular adjustment. This table can also be adjusted to compensate for wheel wear, and can be raised or lowered to permit grinding tools of various sizes. The 18-inch wheel operates at an efficient speed for reducing the time required in the roughing operation.

The tool is finished on the cup-

To obtain additional information on equipment described on this page, see lower part of page 162.



WHAT PRICE CARBOLOY?

Since October, 1928, Carboloy Company, Inc., has continuously passed on to industry, savings in cost that could be effected without detriment to the broad development program being carried on. Under this policy—despite years of profitless operation—a total of seven price reductions were made. Beginning in 1930, the price of a 22½ gram standard Carboloy tool blank, for example, has been steadily reduced from an original $1.00 per gram—to as little as 7½c per gram today. In larger sizes minimum prices per gram are even lower. Prices of complete Carboloy standard tools are now close to the best grades of steel tools.

Background for this development has been the worst depression in the nation's history—poor years for the costly development work needed. But from that work have come vast strides in processing—refinements of the original carbide—many new carbides—new machines, new grinding wheels, new techniques of design, application and maintenance—extensive training of manpower.

Today—in the midst of the most crucial production era in its history—America is reaping the benefits. It has the *domestic capacity* to produce—is actually producing—vital carbides in unprecedented quantities—completely independent of *outside* manufacturers. It also has the *knowledge* to employ those carbides effectively—to obtain performance in the order of 20 to 1 over ordinary tools.

Contributing largely to reductions in cost has been the steady trend towards standardization and mass production techniques. Originally, practically every piece produced was "hand made." Today, automatic presses—operating 24 hours a day—are turning out thousands, millions of blanks for the nation's war plants. A large proportion of Carboloy production is now standard. Continued effort is being made to further divert special requirements into standard lines. For, greater standardization means greater output—greater economy—greater aid towards victory. ★ ★ Carboloy Company, Inc., Detroit, Mich., Chicago, Cleveland, Los Angeles, Newark, Philadelphia, Pittsburgh, Seattle, Worcester, Mass.

CARBOLOY

Reg. U. S. Pat. Off.

TOOLS • DIES • GRINDING WHEEL DRESSERS
CORE BITS • MASONRY DRILLS • WEAR PARTS

MANUFACTURERS OF TOOLS, GAUGES, ETC., SUPPLYING PRODUCTS TIPPED WITH CARBOLOY CEMENTED CARBIDES

B. C. Ames ..... Waltham, Mass.
Apex Tool & Cutter, Shelton, Conn.
Barber-Colman ..... Rockford, Ill.
Bokum Tool ..... Detroit
Carbide Tool ..... Chicago
Cleveland Cutter & Reamer ..... Cleveland
Cleveland Twist Drill ..... Cleveland
Cogsdill Twist Drill ..... Detroit
Cole Carbide ..... Royal Oak, Mich.
A. A. Crafts ..... Boston
Criterion Machine Wks. ..... Beverly Hills, Calif.
Davis Boring Tool ..... St. Louis
Detroit Boring Bar ..... Detroit
Henry Disston & Sons ..... Philadelphia
Eclipse Counterbore ..... Detroit
Ex-Cell-O Corp. ..... Detroit
C. J. Forthman ..... Cincinnati
Gairing Tool ..... Detroit
Gen. Eng. & Model Wks. Pittsburgh
Genesee Tool ..... Fenton, Mich.
Giern & Arholtt Tool ..... Detroit
Goddard & Goddard ..... Detroit
Gorham Tool ..... Detroit
Hartley Wire Die ..... Thomaston, Conn.
Kelly Reamer ..... Cleveland
Kiffer Tool & Die ..... Cleveland
Lincoln Park Tool & Gage ..... Lincoln Park, Mich.
Lovejoy Tool, Springfield, Vermont
Madison Mfg. ..... Muskegon, Mich.
McCrosky Tool ..... Meadville, Pa.
Midwest Tool & Mfg. ..... Detroit
Metro Tool & Gage ..... Chicago
Morse Tool ..... Detroit
Morse Twist Drill & Machine ..... New Bedford, Mass.
Motor Tool Mfg. ..... Detroit
National Tool ..... Cleveland
O. K. Tool ..... Shelton, Conn.
Option Tool & Mfg. ..... Pittsburgh
J. S. Popper, Inc., Union City, N.J.
Production Tool Co. of America ..... Detroit
Reeder Carbide Tool ..... Detroit
R. & M. Mfg. ..... Detroit
Scully Jones ..... Chicago
Sheffield Corp. ..... Dayton, Ohio
Ralph Shipman ..... Sunbury, Pa.
Simonds Saw & Steel ..... Fitchburg, Mass.
Landen P. Smith, Irvington, N. J.
Sommer & Maca Glass Machinery ..... Chicago
Sprague & Henwood, Scranton, Pa.
Standard Gage, Poughkeepsie, N.Y.
Standard Tool ..... Cleveland
Staples Tool & Engineering ..... Cincinnati
L. S. Starrett ..... Athol, Mass.
Strauss Co. ..... Pittsburgh
Super Tool ..... Detroit
Trubor Tool ..... Yonkers, N. Y.
Tungsten Carbide Tool ..... Detroit
United Twist Drill & Tool, Chicago
Van Keuren Co. ..... Boston
Harry W. Wagner ..... New York
Walker Tool ..... Cleveland
Wendt-Sonis Drill Wks. ..... Hannibal, Mo.
Wesson Co. ..... Detroit
Wetmore Reamer ..... Milwaukee

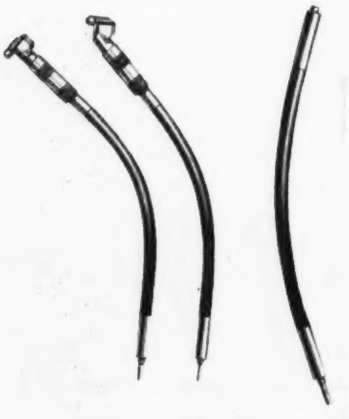
wheel side of the machine. The motor is reversible through a reversing magnetic starter and separate three-button control station. The wet grinding attachment has a separate toggle switch for controlling the motor-driven coolant pump. This machine is also available in 1-H.P. 10-inch and 2-H.P. 12-inch sizes. 77

Stow Flexible Drill Shaft

A flexible drill shaft extension designed to fit into the drill chuck of a portable electric drill has just been brought out by the Stow Mfg. Co., Inc., Binghamton, N. Y. This extension can be bent around corners to get into close quarters that cannot be reached by a regular drill. It is made to stand up under heavy use, the protecting case being extremely rugged, with permanent-grip end-pieces.

The standard length is 30 inches, but any shorter length or longer length up to a maximum of 48 inches can be furnished. The shaft spindle will accommodate either a 1/4-28 or 5/16-24 national fine thread adapter. Drills of any size up to No. 30 can be used.

These attachments can be furnished with straight heads or with Park 45- or 90-degree heads for easy one-hand drilling operations in close quarters. The Park right-angle head with offset spindle or the 45-degree head can be used for drilling within 1/4 inch of angle corners and similar restricted areas. An advantage of these heads is that they permit the use of cut-off or broken drills. 78



Stow Flexible Drill Shafts for Use with Portable Electric Drills

Crater-Eliminator for Weld-O-Tron Arc Welding

A crater-eliminator designed to assure a uniform, neat appearing finish to the end of an arc-welding bead without decreasing strength or ductility has been brought out by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. This crater-eliminator is especially adapted for use with the Allis-Chalmers Weld-O-Tron arc-welder, but is a separate unit consisting of a current adjusting rheostat and motor.

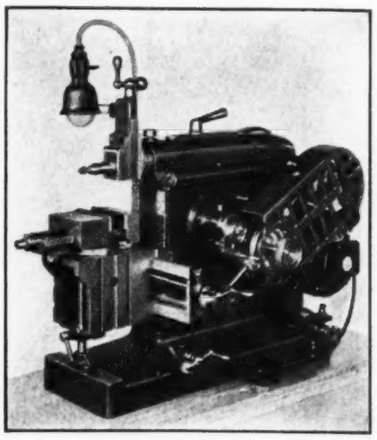
With this equipment, the current is slowly dropped to zero at the end of a weld to eliminate the rough crater-like pit that often forms when the arc is broken.

Allis-Chalmers Crater-eliminator for Arc Welding

This tapering off of the current is accomplished by means of a shading pole type reversible motor that operates a rheostat, which, in turn, operates the welding current. A push-button on the electrode-holder of the welding unit is pressed at the top of the weld and at the end of the weld, automatically changing the current from maximum to normal and then to the low value without disturbing the arc. Since the rheostat automatically returns to the "hot start" setting, no time is lost in starting the next weld. 79

Ammco Precision Shaper

An Ammco 7-inch precision shaper, available for either stationary installation or mounted on a portable cabinet, has been brought out by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill. The features of this machine include quick adjustment of stroke, feeds, the ram position, tool-head, speeds, table height, and table support. The ways of the ram, tool-head, and front face of the main frame are of the vee type. The tool-head is adjustable, and is graduated from 0 to 90 degrees for angular work. The base is also graduated for any angle from 0 to 90 degrees on either side of the center.



Shaper Brought out by the Automotive Maintenance Machinery Co.

Feeds varying from 0.003 to 0.018 inch are provided by the reversible and replaceable type feed mechanism. The countershaft has a four-step V-pulley with special adjustment for the V-belt and motor belt. Pulleys and belt are enclosed behind a hinged type belt guard, designed to permit quick belt changing. 80

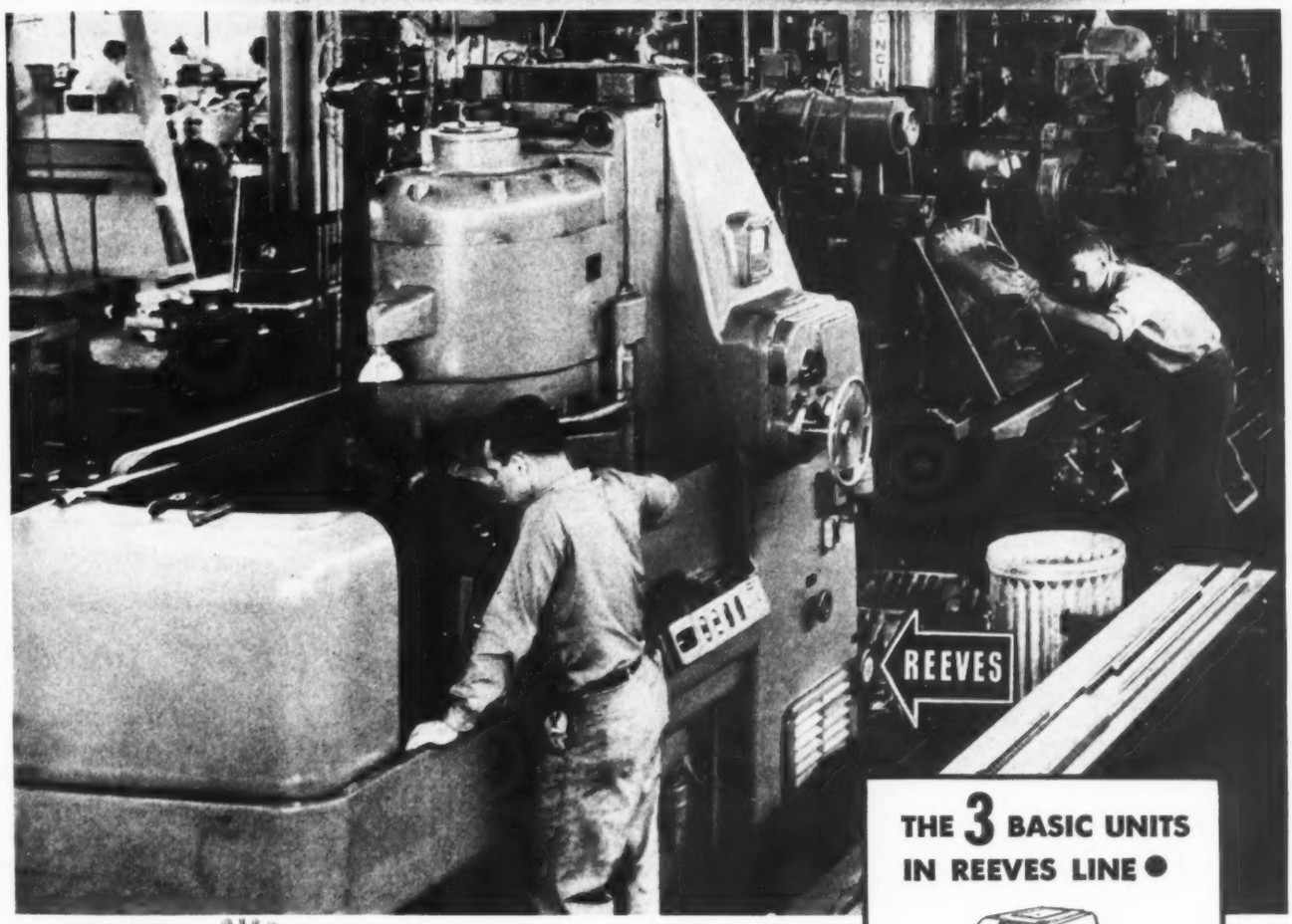
* * *

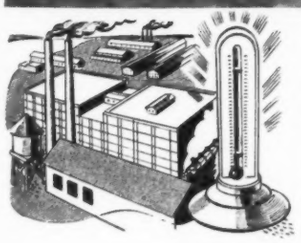
Allis-Chalmers Honors Employes of Long Service

Nearly 6000 employes of the Allis-Chalmers Mfg. Co. have been presented with certificates and emblems of service, indicating that they have been with the company from 10 to more than 50 years. Of these employes, 41 have been with the company 50 or more years. In recognition of their long employment, they were presented with diamond-studded pins. The group having from 40 to 50 years of service is represented by 155 employes; there are 690 in the 30- to 40-year group; 1477 in the 20- to 30-year group; and 3515 in the 10- to 20-year group.

To obtain additional information on equipment described on this page, see lower part of page 162.

"The Heat is On"





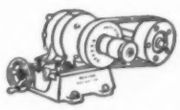
Machines equipped for accurate variable speed control get the "Production Thermometer" UP—and KEEP it up!

The magnetic chuck surface grinder pictured above is working 24 hours a day in a plant manufacturing tanks. It never has to be stopped a minute for speed changes. All the operator has to do is turn a control handwheel and the REEVES Variable Speed Transmission, installed within the frame, provides exactly the speed needed for grinding flat surface parts of all sizes up to a swing of 40 inches. With this ability to speed up and slow down as the work requires, production is faster and more accurate. Now—when the heat is on—when machines must turn out more precision work at a faster rate than ever before, REEVES-equipped machines are giving a good account of themselves. Increases of from 25 to 50 per cent in their output are not unusual.

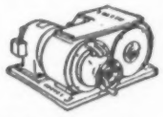
THE REEVES PULLEY CO., *Dept. M,* **COLUMBUS, IND.**

THE 3 BASIC UNITS IN REEVES LINE ●

TRANSMISSION for infinite speed control over wide range, 2:1 thru 16:1. To 87 h.p.



MOTOR PULLEY—simple, direct drive for fractional to 15 h.p. within 3:1 range.



MOTODRIVE combines motor, speed varying unit and reduction gears. To 10 h.p.

REEVES *Accurate Variable* Speed Control

The Facts About the Tungsten-Carbide Industry

By W. G. ROBBINS, President
Carboloy Company, Inc., Detroit, Mich.

In view of the statements made before a committee of the Senate of the United States, which statements distorted the facts and made unfounded accusations in connection with the tungsten-carbide industry, the following rejoinder by Mr. Robbins places on record some of the facts.—EDITOR

I RESENT being called un-American even by inference. This is not the first time accusations have been thrown at the Carboloy Company—accusations in the form of inferences and conclusions that have no foundation in fact, and that apparently are designed almost entirely as a mud-slinging campaign. The whole business would be silly if it were not seriously influencing public morale and destroying confidence at a time when everybody's effort should be directed toward war production.

Mr. Lewin stated that there is a scarcity of tungsten carbide. There is no scarcity and there has never been any. Carboloy has been able to take care of every United States order—and, in addition, has also been supplying England and Russia since 1939. It is asserted that we maintained artificially high prices, even though during the period in question the Carboloy Company made six price reductions, despite the fact that it was continuously operating in the red.

It is inferred that General Electric and Carboloy restricted or are restricting production of this material, and are thereby slowing up the war effort. This is not true. In 1938, the facts show that there were some ninety-seven manufacturers of Carboloy tools in the United States; and at no time were all carbide manufacturers under license or price control. As regards the present patent relationship with Krupp, there just isn't any. Anybody can make carbides.

It was because General Electric appreciated the possibilities of tungsten carbide and secured ownership of the vital patents then owned by Krupp that the Government and war industries can now obtain all the carbides they need. If we had not done so, the United States would have been at the mercy of German sources of supply, just as England was at the outbreak of the war. Fortunately, Carboloy had the production capacity at that time—and still has—to ship enormous quantities of carbides to England, besides meeting the United States requirements.

For years, Carboloy and General Electric have been working closely with the War Department and Government arsenals. For years, there have been available machine tools designed to employ these fast cutting carbide tools. For years, the Carboloy Company has been carrying on an effective and widespread educational campaign on the use of these tools. In one two-year period, long before the war, some 10,000 men in industry were given training courses on the use of these tools.

Even the allegation that an indictment lodged against the Carboloy Company resulted in dropping the price of the material is false. It has been said that, at that time, the price dropped for the first time to $48 per pound, and previously had never been under $200. As a matter of fact, for a year prior to this, Carboloy had been available for less than $48 per pound.

These are all facts that are well known. In the light of this, it is hard to understand the reason behind the constant reiteration of false public accusations. I am indicted in the Carboloy case. Certainly I have the right, as an American citizen, to say that I shall not be smeared before trial by the official prosecutor of my case, either in a Senate Committee hearing or elsewhere.

We are engaged in an all-out war effort. The time and effort of every individual should be vitally concerned only with this. It is hard for a man to keep doing his best when he or the company he works for are constantly being unfairly attacked. Is it not about time we stopped trying to break down our own morale?

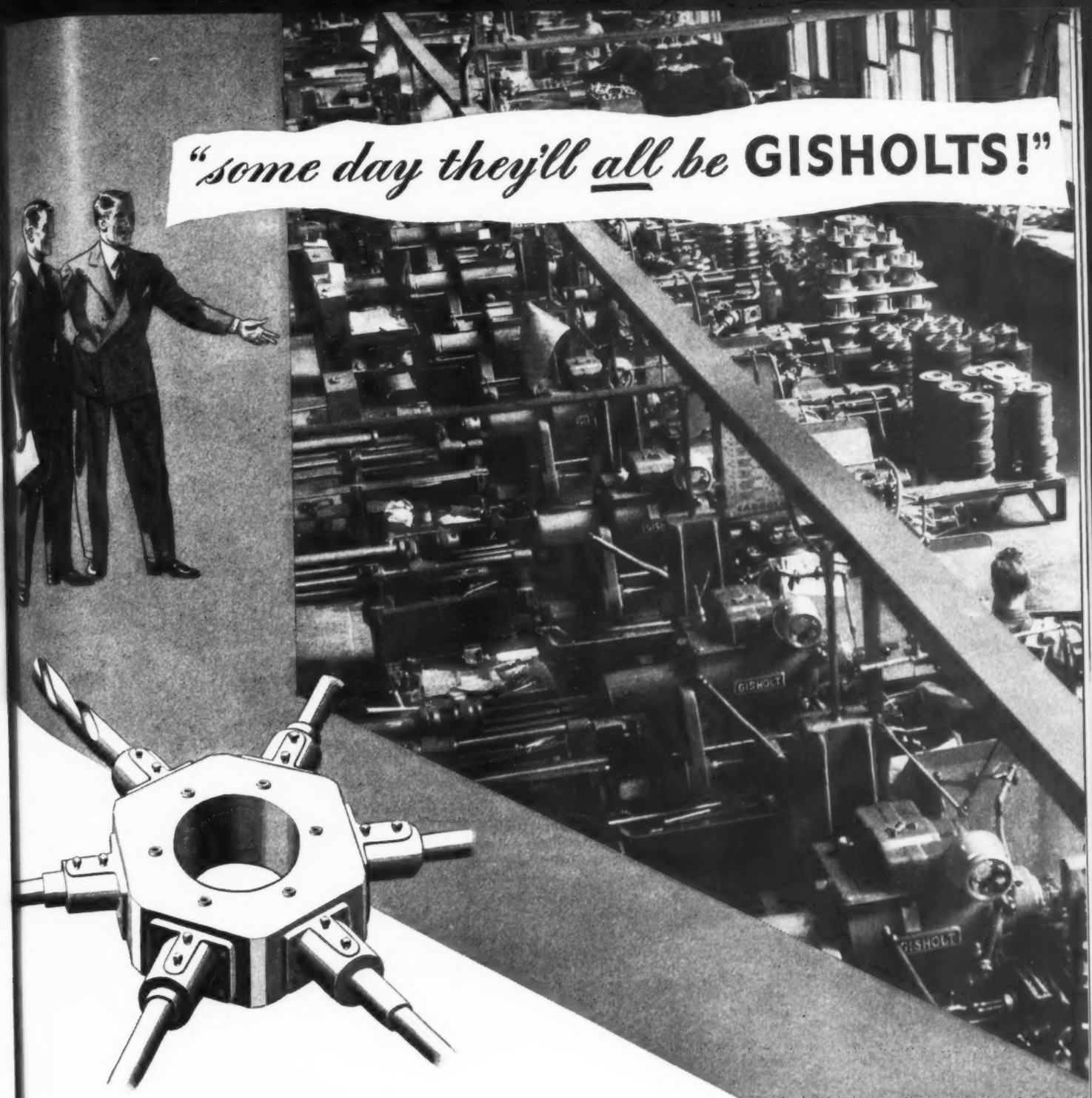
General Electric Suggestion System Brings Results

THE General Electric Co. in 1941 paid its employes $95,203 for 12,453 suggestions, a large percentage of which were ideas for speeding or improving war production. A total of 40,834 suggestions were turned in during the year, 24 per cent more than the previous year; the number accepted was 8 per cent larger.

The largest award was received by Rudolph Black, of Schenectady, who received $800 for an improvement in calibrating radio transmitters. Waclaw Dasziewski, a Polish-born boring-mill operator, cut in half the time required for a step in making bearings and bearing rings for battleships. Miss Genevieve Flood, one of several hundred women to receive awards, suggested a switch assembly improvement and called it "my shot at Hitler."

Nils Thelin saved 12,000 pounds of special steel in another General Electric plant by cutting it in strips 7/32 inch narrower than formerly. Carl E. Tidd, in one of the General Electric New England plants, made thirty-six suggestions, twenty-seven of which were accepted, and received $525.

Nearly 70 per cent of the employes who have been promoted to foremen in the past year were men who had made numerous suggestions. In the last twenty years, the company has paid its employes over $1,100,000 for suggestions of more efficient ways of doing things. Executives and research men are excluded from these awards.



"some day they'll all be GISHOLTS!"

YOU'LL hear it time and again as you get around the machine shops. You'll hear it from production men who've had experience with all kinds of machine tools—who know what it takes to make lower costs.

No wonder we like to put new Gisholts into plants where they haven't been used before. Before long, things begin to show up. Sometimes it's the ability to maintain precision at higher speeds, or to handle a wider variety of work. Again, it's the easier set-up, easier operation, or the freedom from maintenance costs. But whatever it is, the new Gisholts soon make friends with everyone—from operator to treasurer.

That's why you'll find so many men looking toward the day when they won't have to accept any substitute for Gisholt quality. Gisholt Machine Company, 1209 Washington Ave., Madison, Wisconsin.

GISHOLT

LOOK AHEAD—KEEP AHEAD—WITH GISHOLT IMPROVEMENTS IN METAL TURNING

★ TURRET LATHES ★ AUTOMATIC LATHES ★ BALANCING MACHINES ★

NEWS OF THE INDUSTRY

Delaware and Washington, D.C.

AMERICAN CAR & FOUNDRY CO. announces that its Wilmington (Del.) shipyard, one of the oldest shipyards in America, dating back to the time of the early clipper ships, has been awarded the Navy "E" pennant for "excellence in production." The shipyard last year produced a sub-chaser, pontoons, and tank lighters for the U. S. Navy, and is now engaged in building mine sweepers. The formal award was made April 2 by Rear Admiral William Carleton Watts, and was received on behalf of the company by Charles J. Hardy, president of the American Car & Foundry Co.

GOULDS PUMPS, INC., Seneca Falls, N. Y., have established a Washington, D. C., office, in order to facilitate the handling of government business. The new office is located at 505 Colorado Bldg., 14th and G Sts. J. B. DARDEN is in charge.

Illinois

ALLEN-BRADLEY CO., manufacturer of electrical motor control equipment, has removed its Chicago office to new and larger quarters at 624-630 W. Adams St. JOHN MCC. PRICE continues in charge as district manager.

METALLIZING CO. OF AMERICA announces the removal of the company's Chicago general offices and midwestern warehouse to new and larger quarters at 1330 W. Congress St.

J. D. YOUNG has been appointed manager of pump sales for the Tuthill Pump Co., Chicago, Ill. W. J. WAGNER has been made assistant to the president.

Kentucky and Georgia

KENNETH C. JASPER, tool supervisor of the Ordnance Division of the Westinghouse Electric & Mfg. Co., Louisville, Ky., was elected chairman of the new Louisville Chapter of the American Society of Tool Engineers.

GEORGE P. WATKINS has been appointed office manager of the Atlanta branch warehouse of the Crucible Steel Co. of America at 957 W. Marietta St., N. W., Atlanta, Ga. He was previously assistant to the sales manager of the Railway Division.

Otto W. Winter, New President of the American Society of Tool Engineers

Michigan

OTTO W. WINTER, vice-president in charge of manufacturing of the Republic Drill & Tool Co., Chicago, Ill., was elected president of the American Society of Tool Engineers at the annual convention in St. Louis. He succeeds FRANK W. CURTIS, chief engineer of the milling machine division of the Van Norman Machine Tool Co., Springfield, Mass. For the last year, Mr. Winter has served as both first vice-president of the organization and as national chairman of the Emergency Defense Training Committee of the Society.

RAY H. MORRIS, vice-president of Hardinge Brothers, Inc., Elmira, N. Y., has been advanced from the position of second vice-president to that of first vice-president; and D. D. BURNSIDE, superintendent of the American Stove Co., St. Louis, Mo., becomes second vice-president. CLYDE L. HAUSE, sales engineer of the Gorham Tool Co., Detroit, Mich., and FRANK R. CRONE, chief tool designer of the Lincoln Motor Co. of Detroit, were re-elected secretary and treasurer, respectively. ADRIAN L. POTTER, of Springfield, Mass., was named executive secretary of the Society by the board of directors, to succeed the late Ford R. Lamb.

W. D. FISHER has been appointed sales representative and tool engineer in the Detroit district for the McKenna Metals Co., Latrobe, Pa., manufacturer of Kennametal steel cutting carbide tools. Mr. Fisher was associated for seventeen years with the Vanadium Alloys Steel Co. as sales representative in the Michigan territory. His headquarters will be at 14302 Grand River Ave., Detroit.

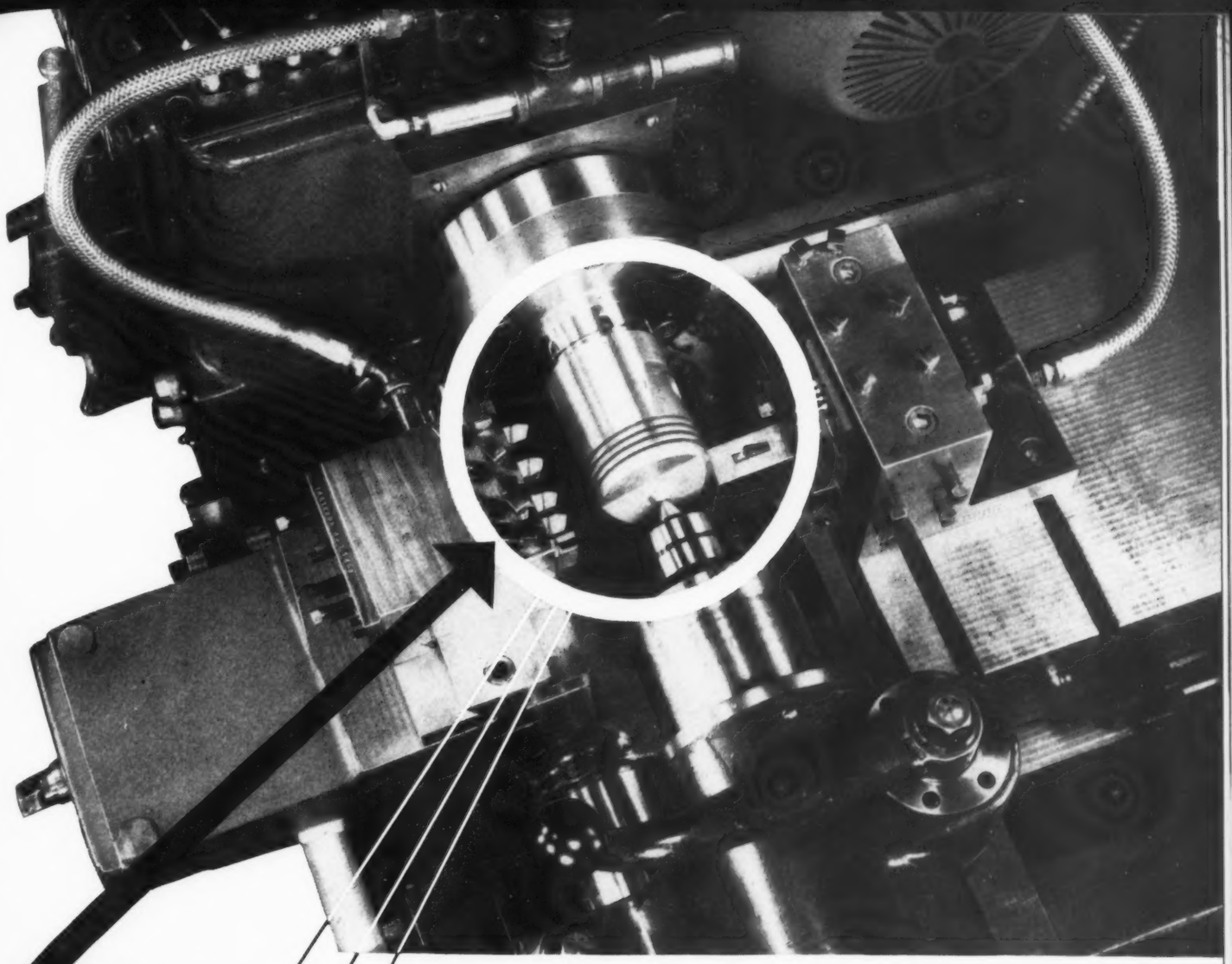
WILLEY'S CARBIDE TOOL CO., Detroit, Mich., is constructing an addition to its plant which will be ready for occupancy early in May. The addition more than doubles the production capacity of tungsten-carbide tools and of Willey's metal. Over 500 people will be employed.

FRED W. CEDERLEAF has been appointed plant manager of the two Detroit plants of the Republic Aircraft Products Division of the Aviation Corporation, Detroit, Mich. Mr. Cederleaf was previously works manager of the Dodge Mfg. Corporation, Mishawaka, Ind.

CLARENCE W. KRUEGER has been appointed sales manager of Whitman & Barnes, with headquarters in Detroit, Mich. GEORGE W. CLARKSON will fill Mr. Krueger's former position as manager of the New York sales office.

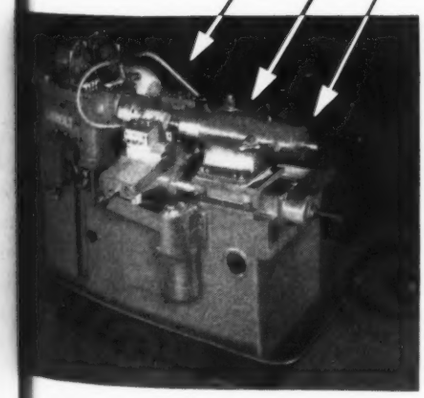
JAMES K. FULKS has been appointed vice-president in charge of manufacturing of the Ex-Cell-O Corporation, Detroit, Mich., maker of precision thread grinding, boring, and lapping machines. He joined the company in 1925, and has been factory manager since November, 1940, in charge of the different Ex-Cell-O plants.

James K. Fulks, Recently Appointed Vice-president in Charge of Manufacturing of Ex-Cell-O Corporation



PISTONS *almost by proxy!*

Within close limits of accuracy, this Gisholt Hydraulic Automatic Lathe is finish-turning and grooving aluminum pistons at the rate of 180 per hour.



YES, here's a machine tool that can substitute and release skilled hands for other important work. It's the Gisholt Hydraulic Automatic Lathe.

By stepping up output and reducing per-piece machining time, the Gisholt Hydraulic Automatic Lathe brings you new low cost advantages. If you have pistons, bearings, gears, pinions or other round parts to be produced in quantities, ask a Gisholt representative for all the facts.

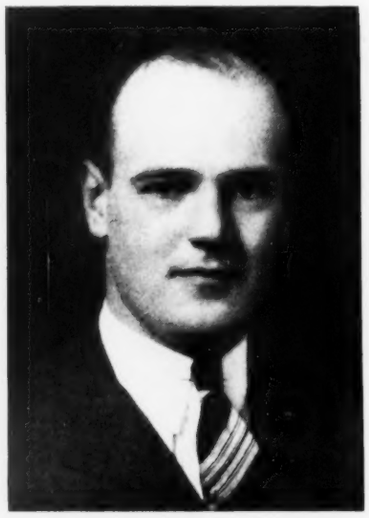
GISHOLT MACHINE COMPANY

1209 EAST WASHINGTON AVENUE • MADISON, WISCONSIN

Look ahead . . . keep ahead . . . with Gisholt improvements in metal turning

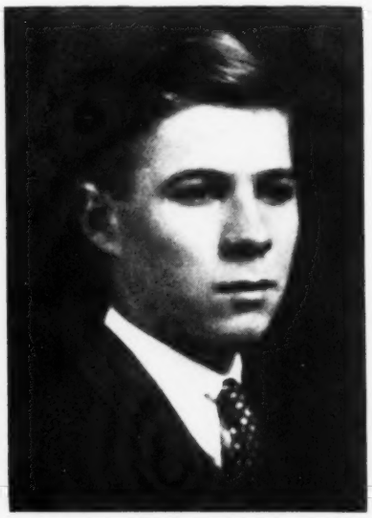
GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES



Edward P. Bullard III, Vice-president in Charge of Manufacturing of the Bullard Co.

John A. Bullard, Recently Elected a Director of the Bullard Co.



J. W. C. Bullard Jr., Another Newly Elected Director of the Bullard Co.

New England

EDWARD P. BULLARD, III, has been elected vice-president in charge of manufacturing of the Bullard Co., Bridgeport, Conn., manufacturer of machine tools. JOHN A. BULLARD, son of the late A. H. Bullard, who was treasurer of the company, and J. W. C. BULLARD, JR., whose father is vice-president in charge of research, were elected to the board of directors at the annual meeting. E. P. Bullard, III, whose father is president of the company, was graduated from Exeter and Yale University (1932) and attended the Harvard School of Business Administration. He is the designer of the Bullard "Cut Master" vertical turret lathe, and developed a descaling machine for the Bullard-Dunn metal cleaning process. He has also designed many tools for the company and its customers. E. P. BULLARD, JR., was re-elected president of the firm, and E. C. BULLARD was again named vice-president and general manager.

PRATT & WHITNEY DIVISION OF THE UNITED AIRCRAFT CORPORATION, East Hartford, Conn., was presented with the Navy "E" award March 24 for production achievements in the aircraft engine field. The award was presented by Rear Admiral John H. Towers, chief of the Bureau of Aeronautics of the United States Navy, and was accepted by H. M. Horner, general manager of the division and a vice-president of the United Aircraft Corporation.

ALFRED KENT, Dallas, Tex., representative of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has joined the United States Navy, and is now an ensign on active duty. FRED CRABBE, who formerly covered the Corpus Christi territory, has been transferred to Dallas for the duration of the war.

G. ARTHUR GUSTAFSON has been appointed to the newly created position of supervisor of manufacturing for the plastics department of the General Electric Co. at Pittsfield, Mass. Mr. Gustafson was formerly manager of the Meriden and Taunton divisions of the plastics department. JAMES D. MILNE, Fort Wayne division manager, will succeed Mr. Gustafson at Meriden; CLARENCE W. COE and EVERETT W. BICKFORD become division managers of the Fort Wayne and Taunton plants, respectively.

G. Arthur Gustafson, Supervisor of Manufacturing for the General Electric Plastics Department

New York and New Jersey

HOWARD COONLEY, chairman of the board of the Walworth Co., New York City, has been appointed for three months to head the Simplification and Standardization Program of the War Production Board. Mr. Coonley is a past-president of the American Standards Association and also a former president of the National Association of Manufacturers.

GEORGE G. RAYMOND, JR., has been elected assistant treasurer of the Lyon-Raymond Corporation, Greene, N. Y., manufacturer of hydraulically operated material-handling equipment. Mr. Raymond is now serving as sales promotion manager, a newly created position devoted to the analyzing of special material-handling problems.

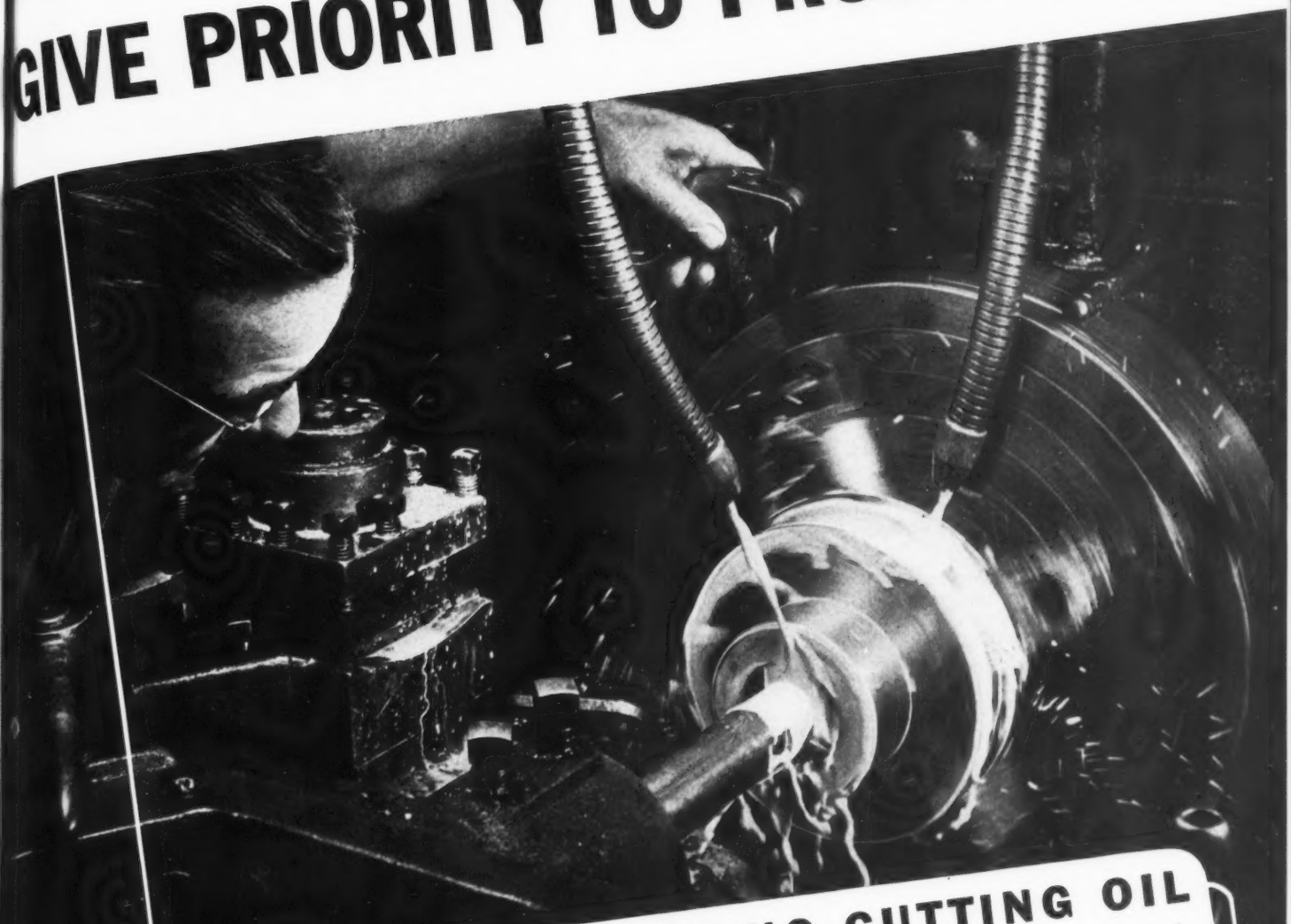
GENERAL ELECTRIC CO., Schenectady, N. Y., announces that an electronic control section has been organized in the industrial control division. ALLEN E. BAILEY, JR. and WILLIAM D. COCKRELL will be manager of sales and engineering, respectively, of the new section.

GIEBEL MACHINE TOOL CO., 250 W. 57th St., New York City, on April 1 completed ten years in the tool-room and production machine tool business.

W. C. LIPE, INC., Syracuse, N. Y., has changed the firm name to the LIPE-ROLLWAY CORPORATION.

J. H. MATTHEWS and O. H. CILLEY were elected members of the board of directors of Raybestos-Manhattan, Inc., Passaic, N. J., at a recent meeting of the stockholders. Mr. Matthews is assistant general manager of the

GIVE PRIORITY TO PRODUCTION



SUNOCO EMULSIFYING CUTTING OIL

permits increased speeds and feeds . . . longer tool life

To keep American tanks, planes, guns and shells streaming from assembly lines, machine tools — those master tools for victory — must operate at continuous top speed. Unproductive "set-up" time must be cut to the minimum . . . speeds, feeds and tool life increased . . . extreme accuracy maintained — all to produce more work in less time.

That's the problem Sun Oil Engineers — those "Doctors of Industry" — have solved by putting Sunoco Emulsifying Cutting Oil to work in plants throughout the nation.

Sun "Doctors of Industry" are ready . . . willing and able to help you increase machine tool productivity in your shop . . . under your own operating conditions. Their services are yours to use in stepping up output. Write or wire

SUN OIL COMPANY, Phila.

LET'S GO! U.S.A. KEEP 'EM FLYING!

ERFORMANCE DATA

PERATION—Machin-g coupling from steel rging @ 98 R.P.M.

ACHINE — 2-L Gis-olt Turret Lathe.

OLERANCE—.001".

UTTING LUBRICANT —1 part Sunoco to 15 arts water.

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

Manhattan Rubber Mfg. Division of the company, and Mr. Cilley is assistant general manager of the U. S. Asbestos Division at Manheim, Pa.

NATIONAL ACME CO., Cleveland, Ohio, announces that its eastern office has been moved from 125 Barclay St., New York, to 744 Broad St., Newark, N. J.

Pennsylvania and Ohio

EDWARD HARTMUSS received the highest award of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., when he returned from rebuilding the generator on an ocean-going ship. Mr. Hartmuss has completed nearly a half century of work with electricity. He has been building power generators since Westinghouse pioneered in the hydro-electric field at Niagara Falls nearly five decades ago. In recognition of his outstanding service with the company, he was awarded the Order of Merit by the board of directors. The award, which was presented to him by A. C. Streamer, vice-president in charge of the East Pittsburgh Division, was a silver "W" medal, together with a citation in tribute to his "ingenuity and skill in building and repairing all types of rotors and stator cores, and his dependability in completing jobs, regardless of the difficulties encountered."

B. W. CLARK, vice-president in charge of the merchandising division of the Westinghouse Electric & Mfg. Co., has been appointed vice-president in charge of sales, succeeding RALPH KELLY who resigned to become executive vice-president of the Baldwin Locomotive Works. Mr. Clark will transfer his headquarters from Mansfield, Ohio, to Pittsburgh, Pa. JOHN H. ASHBAUGH, manager of manufacturing and engineering of the merchandising division, has been appointed manager of that division, with headquarters in Mansfield, Ohio.

DR. MAURICE C. FETZER, formerly assistant professor of metallurgy at Pennsylvania State College, has joined the staff of the Carpenter Steel Co., Reading, Pa., as a research metallurgist. He is a graduate metallurgical engineer from the University of Minnesota and received the degree of Sc.D. from Harvard University. He is a member of the American Society for Metals, American Institute of Mining and Metallurgical Engineers, and British Iron and Steel Institute.

R. S. AHLBRANDT, Pittsburgh district sales manager for the Allegheny Ludlum Steel Corporation, has been given leave of absence to accept a lieutenant's commission in the United States Navy. Mr. Ahlbrandt was a graduate of Annapolis and a member of the Naval Reserve. His background of experience in the steel industry and his earlier naval training were the chief factors in his call by the Navy to a post in Washington.

R. W. AIKEN has been appointed plant engineer of the Jessop Steel Co.,

R. W. Aiken, Newly Appointed Plant Engineer of the Jessop Steel Co.

Washington, Pa. He was previously chief engineer with Frazier-Simplex, Inc. of Washington.

RUSSELL B. BARNETT, formerly Buffalo branch manager for Peter A. Frasse & Co., Inc., New York City, is now manager of the Philadelphia branch. Previous to his connection with this company, he was assistant sales manager of the Union Drawn Steel Division of the Republic Steel Corporation. LESLIE N. STETSON, former Frasse sales representative in the Buffalo area, will succeed Mr. Barnett as Buffalo branch manager.

R. G. FORSBERG has been appointed purchasing agent of the Jessop Steel Co., Washington, Pa., succeeding R. J. MURRAY, who is now secretary and assistant treasurer. Mr. Forsberg was formerly assistant purchasing agent, and previous to joining the Jessop organization in April, 1941, served eight years in the purchasing department of the Timken Roller Bearing Co., Canton, Ohio.

RALPH C. EDGAR has been made manager of industrial relations for Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Edgar has been engaged in public relations work for a number of industrial concerns and commercial organizations. Since 1940 he has been industrial manager of the Chamber of Commerce of Pittsburgh.

DAVID F. ROBINSON, New York district sales manager for William Sellers & Co., Inc., Philadelphia, Pa., has been granted a leave of absence for the duration of the war, and is now working under Commander Paul E. Piehl of the United States Navy Aeronautics Bureau in Washington.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., is building a new reclamation plant which will concentrate on saving the alloy metal content of low-alloy steels. This plant will increase the company's present salvaging capacity for essential metals such as nickel and chromium.

BIRDSBORO STEEL FOUNDRY & MACHINE CO., Birdsboro, Pa., has recently awarded a contract to the Turner Construction Co. of New York for the erection of a one-story structure which will provide more than eight acres of production space under one roof.

EDWARD A. LYNCH MACHINERY CO., machine tool and metal-working machinery distributor, has moved from Philadelphia to new quarters in the Times Medical Bldg., Ardmore, Pa.

LOUIS LINGLER, of the Sheffield Corporation, Dayton, Ohio, is giving a series of lectures to students in universities and defense training classes on "Gaging Practices in Modern Industry." So far, Mr. Lingler has spoken before upwards of one hundred groups of students in Ohio, Illinois, and Michigan.

* * *

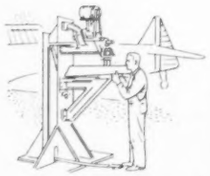
Government Needs Engineers and Chemists

The Federal Civil Service Commission is endeavoring to find engineers and chemists experienced in production engineering and scientific research work essential in the successful operation of industrial plants, especially for plants making explosives, plastics, rubber products, and textiles. The salaries for the positions range from $2000 to $5600 a year. Applications may be filed with the Federal Civil Service Commission, Washington, D. C. Application forms can be obtained at any first- or second-class post office.

* * *

When sacrifices are being demanded of private business and of private citizens, the presence of tens of thousands of government employes in unessential activities is inexcusable. To keep faith with the people, the Government should slash two billions of expense from the budget for these unessentials.—*E. L. Shaner, in "Steel"*

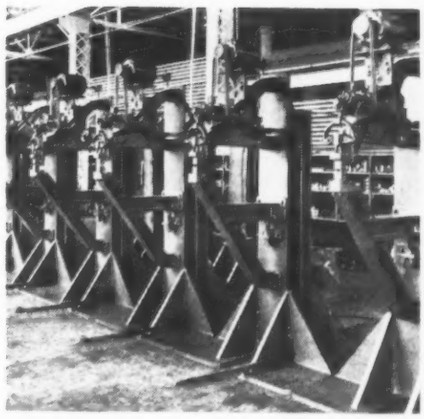
Taps— 1200 per Minute



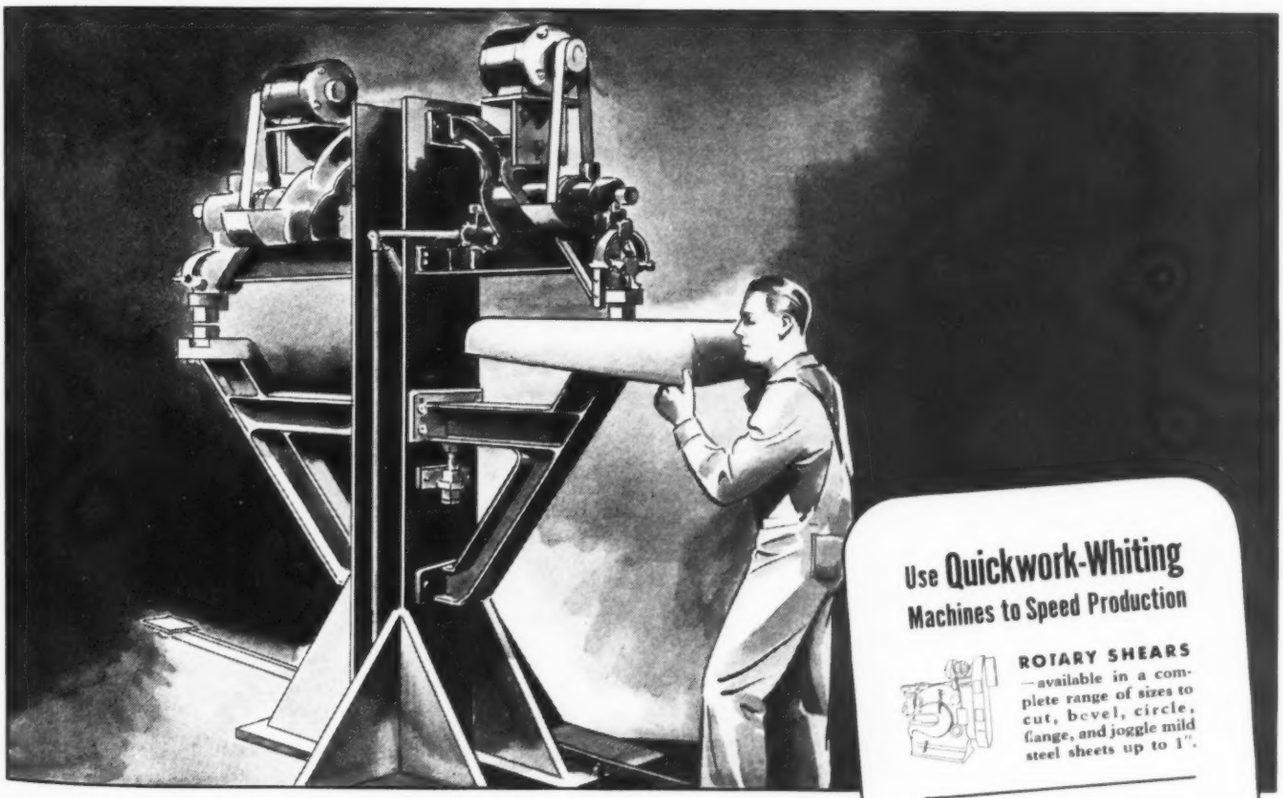
Constant speed—unvarying rhythm—*the force of the blow is varied without interrupting the operation.* These are the special advantages of Quickwork Whiting Power Hammers. These features enable the operator to increase production from 25 to 50%—save time, and make it easier for him to do a perfect job. Foot pedal control is accurate, positive.

Quickwork-Whiting Power Hammers handle work ranging from light seam flattening to intricate forming and flanging operations on heavy gauge steel. They are rugged, substantial machines built for constant hard work and rough usage. Available in four sizes with columns, special dies, and pedestals as required.

Write for complete information.



Quickwork-Whiting Power Hammers are widely used in the aircraft industry. This illustration shows part of a battery of Quickworks built for one manufacturer.



Use Quickwork-Whiting Machines to Speed Production

ROTARY SHEARS—available in a complete range of sizes to cut, bevel, circle, flange, and joggle mild steel sheets up to 1".

STAMPING TRIMMERS—economical, time-saving machines for trimming light or heavy gauge stampings in a single plane.

"QUICKWORK" WHITING

Division of Whiting Corporation, 15673 Lathrop Ave., Harvey, Illinois

OBITUARIES

H. A. Schatz

H. A. Schatz, president of the Schatz Mfg. Co. and of the Federal Bearings Co., Inc., Poughkeepsie, N. Y., died on March 16 at the age of sixty-five years. Mr. Schatz was one of the pioneers in the ball bearing industry, and for over forty-seven years had been engaged in the manufacture of ball bearings for motor cars, aircraft, and industrial purposes.

Mr. Schatz was born in New Haven, Conn., and went to Poughkeepsie as a young man, where he and his father, the late Adolph Schatz, established the Schatz Mfg. Co. and the Federal Bearings Co. Later the Waterbury Steel Ball Co. was acquired, of which Mr. Schatz was secretary and treasurer. The latter company is a wholly owned subsidiary of the Federal Bearings Co., Inc.

Mr. Schatz was also vice-president and a director of the First National Bank of Poughkeepsie.

AUGUST C. ULLRICH, SR., superintendent of Gould & Eberhardt, Inc., Newark, N. J., died suddenly on March 27 following an operation at the St. Barnabas Hospital in Newark. Mr. Ullrich learned his trade in the Gould & Eberhardt shop, and held various positions with the company until he became superintendent. Last year he celebrated his fiftieth anniversary of service with the company. During his early years he taught machine tool construction in the high schools of Newark. For six years he served as a member of the Board of Education of Hillside, the town in which he lived, and was also a member of various fraternal organizations. He is survived by his wife and two sons.

HARRY G. STEELE, president of the U. S. Electrical Motors, Inc., Los Angeles, Calif., died suddenly at his home in Pasadena on April 2, following a heart attack, aged sixty years. Mr. Steele had been head of the company with which he was connected for the last twenty-two years. Prior to making his home in Southern California, he was part owner of the Pittsburgh Transformer Co. in Pittsburgh, Pa. He is survived by his wife, two sons, and three daughters.

Help the War Effort by Preventing Waste of Materials

Posters headed "Don't waste it!" printed in red and blue on a white background, have been prepared by the Jas. P. Marsh Corporation, 2073 Southport Ave., Chicago, Ill. These posters are available in reasonable quantities to anyone in the industry asking for them. They are approximately 22 by 30 inches in size and read as follows:

"Everyone agrees that production will win the war. The greater the production—the more efficient the production—the quicker the victory will come.

"But . . . production rests on material. And material is so scarce that our Government has found it necessary to ration it.

"The work we are doing here is sufficiently essential to earn us the privilege of obtaining some scarce and vital materials. That means jobs for us and the privilege of doing our part.

"Let's not abuse this privilege! Let's show our appreciation of it by doing everything in our power to prevent waste and spoilage of metals and materials of all kinds.

"Save materials here; save them at home; save as you have never saved before. Every ounce of metal and material you save is a contribution to Victory for all of us."

Instruction in Blueprint Reading by Motion Pictures

A new method of training machine shop apprentices and operators in blueprint reading is introduced in a two-reel sound film brought out by the Film Productions Co., Minneapolis, Minn. The object of the film is to enable the average shop apprentice and operator to grasp the fundamentals of blueprint reading quickly. By animated drawings and other photographic effects, the film shows many things that are difficult to explain in print or by personal instruction. The first reel is recommended as an introduction to the subject of blueprint reading, while the second reel can be used for the advanced instruction of men already familiar with drawings.

COMING EVENTS

MAY 1—Spring meeting of the ASSOCIATED MACHINE TOOL DEALERS OF AMERICA at the Hotel Cleveland, Cleveland, Ohio. Thomas A. Fernley, Jr., executive secretary, 505 Arch St., Philadelphia, Pa.

MAY 10-12 — Twenty-sixth annual convention of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Hotel Hershey, Hershey, Pa. J. C. McQuiston, manager - secretary, 602 Shields Bldg., Wilkinsburg, Pa.

MAY 13-14—PRODUCTION FOR VICTORY CONFERENCE under the auspices of the AMERICAN MANAGEMENT ASSOCIATION at Hotel Astor, New York. For further information, address the Association at 330 W. 42nd St., New York.

MAY 31-JUNE 5 — Semi-annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary, 29 W. 39th St., New York City.

JUNE 8-10—Semi-annual meeting of AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Cleveland, Ohio. Secretary, C. E. Davies, 29 W. 39th St., New York City.

JUNE 22-26—Forty-fifth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary - treasurer, 260 S. Broad St., Philadelphia, Pa.

OCTOBER 12 - 16 — NATIONAL METAL CONGRESS AND EXPOSITION in Detroit, Mich., sponsored by the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland.

NOVEMBER 17-22 — NATIONAL CHEMICAL EXPOSITION AND INDUSTRIAL CHEMICAL CONFERENCE at the Stevens Hotel, Chicago, Ill. For further information, address National Chemical Exposition, 110 N. Franklin St., Chicago, Ill.

NOVEMBER 30-DECEMBER 3 — Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Astor, New York City. Secretary, C. E. Davies, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 5—Fifteenth NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

Announcing...

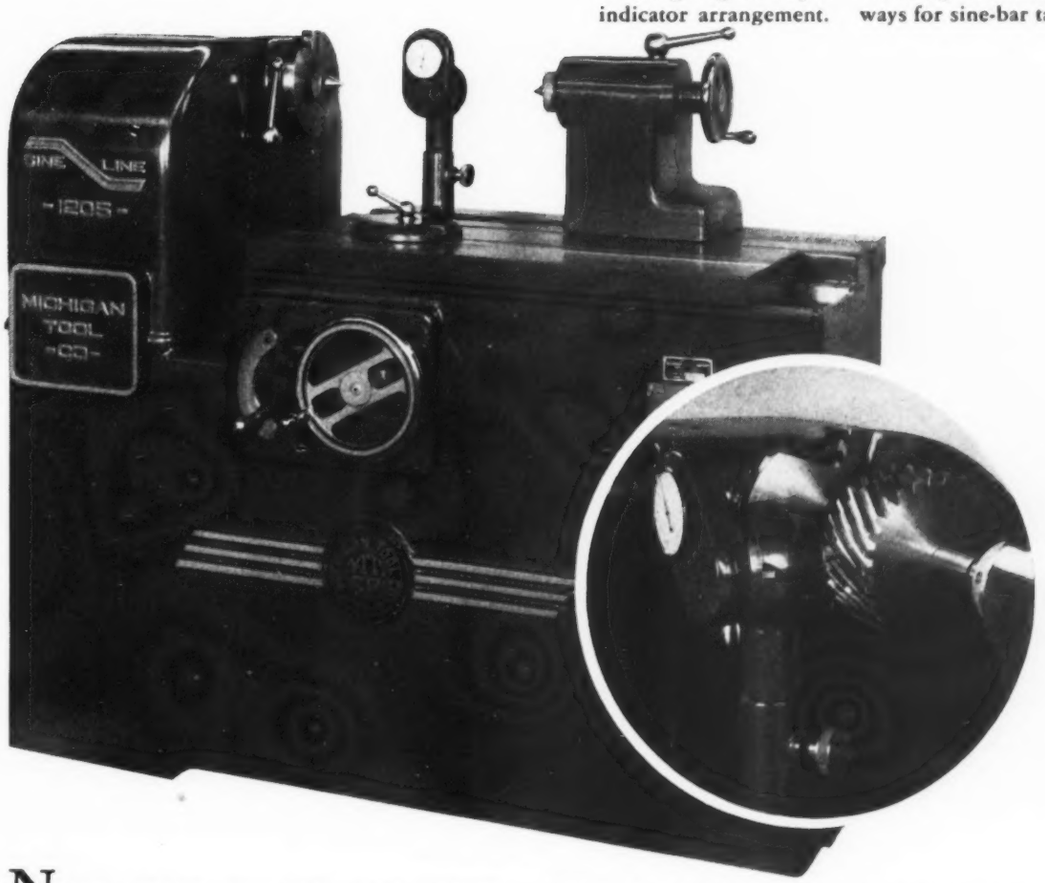
LEADS *from* ZERO *to* INFINITY

1 UNIVERSAL—no master rolls or discs or lead screw required.

2 CONVENIENT—all adjustments at working height. Simple indicator arrangement.

3 FAST—saves time in setup and checking of gears.

4 ACCURATE—Maximum rigidity. Narrow guides and wide ways for sine-bar table.



NOW ADDED to *Michigan* "Sine-Line" gear checking equipment is the new model No. 1205, a lead checker that will handle gears with leads from zero to infinity. Universal and flexible, it has been designed for maximum accuracy and speed in production and laboratory checking of gears.

Convenient to set up, all adjustments are at 'working' height while sine-bar setting can be checked with either gage blocks or micrometer. The indicator arrangement is extremely simple and easy to swing into contact, saving time in gear checking. The No. 1205, like other *Michigan* "Sine-Line" gear checkers, is designed for use, if desired, in combination with the *Michigan* gear-checking recorder unit.

We will be glad to send you complete information. Ask for Bulletin No. 1205-42.

MICHIGAN TOOL
7171 E. McNichols *Company* **Detroit, U. S. A.**

NEW BOOKS AND PUBLICATIONS

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1942). 5200 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, $15. (Renewals, $10)

This is the thirty-second edition of a complete purchasing guide covering all American manufacturers and their products. It contains four principal sections printed on different colored paper for ready reference. The first section is a finding list, or index, containing an alphabetical listing of all the products covered in the classified section. The second and main section of the book, covering 4172 pages, comprises a list of manufacturers, classified according to their products and grouped according to geographical location. The general classifications of products are carefully sub-classified, so that the user can easily find the specific product that will best meet his requirements. A capital or size rating is given for each manufacturer.

The third section gives an alphabetical list of the manufacturers of each specific product, together with their addresses and, in many cases, home offices, branches, affiliations, succeeding concerns, cable addresses, etc. The fourth section contains an alphabetical list of trade names and brands of the various products. There are two appendixes in the book, the first of which gives a list of banks, boards of trade and other commercial organizations, and the second a list of leading trade papers.

The book is completely indexed and cross-indexed, so as to make it possible to find information quickly and conveniently. It provides a convenient means of locating sources of supply, and should be of great value to purchasing and sales departments or anyone who has occasion to make up lists of manufacturers for any purpose. Those who make constant use of this directory are impressed by its completeness and accuracy. To meet the demands of users, the book can be provided with a thumb-index for $1 additional.

INDUSTRIAL SUPERVISION. By Vernon G. Schaefer and Willis Wissler. Published in two volumes. Volume I, 283 pages, 5 by 7 1/2 inches. Volume II, 267 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $1.75 each.

This work on industrial supervision is published in two volumes, the first of which deals with organization and the second with controls. The material is based on experience obtained at the Pennsylvania State College in carrying on supervisory training in the industries of Pennsylvania over a period of twenty years. During the early years, the text material was published as mimeographed pamphlets, and later was printed in book form. The present revision was necessitated by a shift in emphasis on supervisory training to the point where the problem of getting out production in the defense or war effort became paramount. The chapter on planning has been completely rewritten, and chapters on the foreman in labor relations and on job evaluation have been added.

The volume on organization discusses the following subjects: Industrial Development; The Foreman's Job; The Foreman as Manager; Harmonious Relations in Industry; Analysis of Workers' Jobs; Job Evaluation; Selection and Placement; Training; Merit Rating; and Production Planning. The volume on controls deals with: Human Nature; Interesting the Worker; Building Morale; Reducing Turnover; Promoting Safety; Dealing with Grievances; Waste Control; Labor Relations; Industrial Economy for the Foreman; and Leadership.

DIAMOND AND GEM STONE INDUSTRIAL PRODUCTION. By Paul Grodzinski. 256 pages, 5 1/2 by 8 1/2 inches; 183 illustrations and 32 tables. Published by N. A. G. Press, Ltd., 226 Latymer Court, London, W. 6, England. Price, 15/.

The increasing use in industry of hard natural and synthetic stones and gems involves greater need for knowledge of the methods and machinery by which these materials are brought to their final shape. The author of this book brings before the industrial reader a general survey of the accepted methods of splitting, cleaving, bruting, grinding, and polishing flat and curved surfaces and holes. The material in the book has been sifted and logically arranged, with the object of presenting a systematic and scientific treatment of the art of cutting and polishing hard materials.

Most methods of machining diamonds and gem stones have not changed for a long time, passing from one generation to another. These methods have proved to be of great assistance in machining the synthetic materials produced in recent years, which have become of great industrial importance. Hence, the material in this book is based to a large extent on the traditions of craftsmanship. The full application of modern technique has been made in this field only during recent years, and is to some extent experimental. Where information is available on these newer methods, they have been referred to.

PILOTS' AND MECHANICS' AIRCRAFT INSTRUMENT MANUAL. By G. C. DeBaud. 490 pages, 6 by 8 3/4 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

The author of this book is well qualified to write on the subject, being flight lieutenant with the Royal Canadian Air Force, as well as aeronautical engineering officer in charge of the R.C.A.F. instrument repair base and ground instructor on aircraft instruments. The book is designed to meet the requirements of thorough, systematic courses in technical and aviation schools, as well as the needs of those who wish to acquire a complete understanding of instruments but who do not have the opportunity of an instructor's guidance. There are thirty-two chapters explaining the construction, purpose, and necessity of all of the instruments used in aircraft—the errors that might occur and their remedies, and the instruments' installation and maintenance. Each chapter deals with a different instrument. One of the final chapters contains lessons in instrument flying.

MANUFACTURING PROCESSES. By Myron L. Begeman. 579 pages, 6 by 9 inches; profusely illustrated. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $4.50.

This book, which is written primarily for engineering students, covers the technical fundamentals of important manufacturing processes, engineering materials, and modern equipment necessary for processing these materials. In addition to supplementing the usual shop laboratory practice, it is also useful as a textbook for courses without laboratory work or for short industrial courses. The book covers foundry practice; pattern work; metal casting; die-casting; plastic molding; heat-treatment of steel; welding, soldering, and hard-surfacing; hot- and cold-forming of metals; inspection — measuring instruments and gages; lathes, lathe work, and lathe tools; threads and thread cutting; shapers and planers; drilling and boring machines; milling machines and cutters; gears and gear-cutting machines; metal sawing; broaching machines and tools; turret and automatic lathes; abrasives, grinding wheels, and grinding machines.

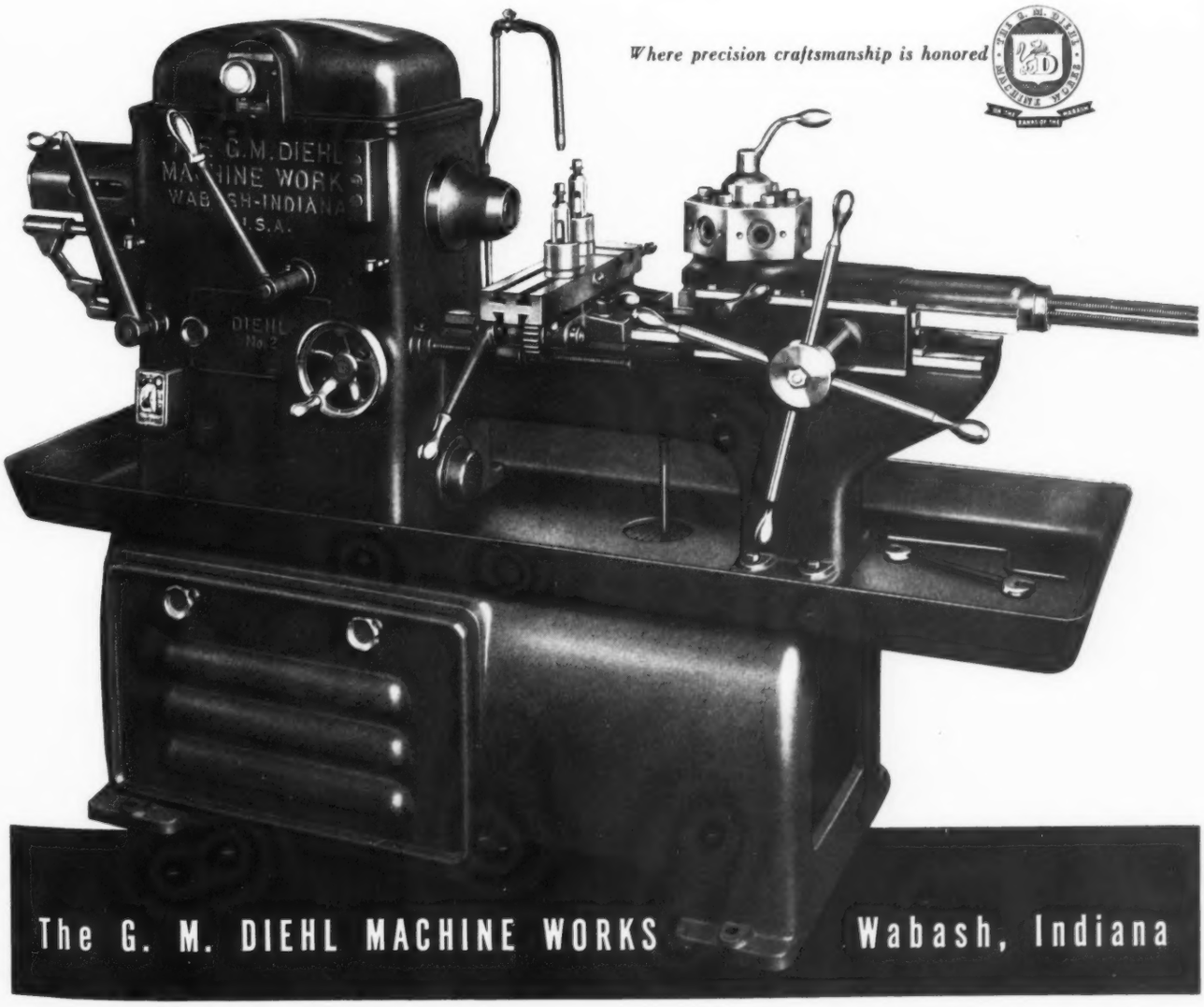
DIEHL

The big name in precision woodworking machinery ... *NOW A NEW NAME* in turret lathes!

The world over, manufacturers of veneers, quality cabinetry, and fine furniture recognize the name "Diehl" as the mark of precision woodworking machinery. We now take our valued reputation into the metal-working field . . . confident that it will be sustained by our Turret Lathe. We are producing this precision machine tool to help meet the desperate need in America's War Production Industries.

The Diehl Turret Lathe is the accepted standard No. 2 size . . . capacity up to 1" diameter with 14" swing . . . and works alongside any other No. 2 lathe of standard make, using same tooling, including collets. Power feed available. It is ruggedly built for long, economical service . . . ample power and scientifically distributed weight for the extreme war production requirements. Details on request.

Where precision craftsmanship is honored



The G. M. DIEHL MACHINE WORKS Wabash, Indiana

Morey Completes One-Hundredth Vertical Shaper for the War Department

Saturday, April 18, Sigmund Morey, president of the Morey Machinery Co., Astoria, N. Y., presented the one-hundredth vertical shaper to come off the production line to Captain Donald B. MacMaster of the Department of War. These shapers, used chiefly in the manufacture of breech-block mechanisms for guns, are also employed in die and tool shops making equipment for war manufacture. The event was made the occasion of appropriate ceremonies which were attended by the men in the plant who helped to produce the shaper.

The Morey Machinery Co. was established in 1914 to rebuild machine tools and to deal in used equipment. In the latter part of 1939, the company began to design machine tools that would be needed in the defense effort. The rebuilding plants were converted to the manufacture of new machine tools. Besides working its own plants to full capacity, the company employs many sub-contractors.

Simplified Practice for Wrought-Iron and Wrought-Steel Pipe, Valves, and Fittings

With the approval of the Standing Committee for Simplified Practice Recommendation R57-32 on wrought-iron and wrought-steel pipe, valves, and fittings, the Division of Simplified Practice of the National Bureau of Standards has submitted a proposed revision of the recommendation to all interested in this matter, for their consideration and acceptance. The present revision was proposed by the Manufacturers Standardization Society of the Valve and Fittings Industry. Mimeographed copies of the proposed revision can be obtained without charge from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

Milling Speed and Feed Calculator

The Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio, is distributing a handy device for quickly selecting the correct cutting speeds and feed rates for many milling jobs. The size and kind of cutter, the work material, depth of cut, cutting speed, feed rate, and horsepower required are all calibrated on the dials of the calculator. By setting the dials in accordance with the data for the particular job being handled, it is possible to determine the most effective combination of speed and feed from the standpoint of power, tooth load, and finish. An instruction book gives complete directions for using the calculator. The price of the calculator is fifty cents.

* * *

The Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill., has issued Defense Bulletin No. 1, explaining to users of temperature measuring and control instruments how the war program affects these instruments, their purchase, use, maintenance, and replacement. The purpose is to aid users to maintain equipment so it will give uninterrupted service.

Arc-Welding Movie Now Available

The General Electric Co. has announced that the movie "The Inside of Arc Welding," which was referred to in April MACHINERY, is now available to industrial plants and educational institutions, training courses, etc., by communicating with the General Electric's Visual Instruction Section, Schenectady, N. Y. Films can also be obtained by applying to the nearest General Electric office.

* * *

Management Course at University of Iowa

The University of Iowa is again offering a three-week management course from June 8 to 26 this summer. The course is designed primarily for people from industry who want intensive, comprehensive training in production planning, plant lay-out, motion and time study, and related subjects. Those responsible for increasing production in the war industries will find this course of especial benefit. For further information, address Professor Ralph M. Barnes, 107 Engineering Bldg., University of Iowa, Iowa City, Iowa.

R. Hoe & Co. Celebrates Noteworthy Achievement

An outstanding accomplishment in ordnance manufacture was celebrated by R. Hoe & Co., Inc., New York City, peacetime manufacturer of printing presses, at a victory rally in their plant on April 11. The rally was a tribute to the workmen of this company who had made possible the completion of a second order for vital ordnance several months ahead of schedule. In looking forward, company officials pledged themselves and their associates to even greater efforts in completing, on time, more difficult assignments from the United States Bureau of Ordnance.

* * *

Two Essentials for Maximum War Production

Speaking of the reasons why the N. A. Woodworth Co., Ferndale, Mich., has been able to obtain a very high production rate on war material output, Mr. Woodworth, president of the company, said that this was due largely to (1) a systematic training program for unskilled labor, which in a minimum time, qualified men and women for what generally has been considered skilled work; and (2) plant equipment which can be tooled for war work with the least possible loss of time. Through the application of these two fundamentals, the company has been able to increase its production at a most unusual rate in the last two years.

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Contest on Compressed Air Application

A prize contest is being conducted by the Compressed Air Institute relating to compressed air application ideas. Cash prizes totaling $1000 are being offered. The contest closes July 1. For further information, address the Institute at 45 Warrington Place, East Orange, N. J.

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The American Gear Manufacturers Association reports that industrial gear sales for March, 1942, were 28.8 per cent above February this year, and 58 per cent above March, 1941. The three months ending with March 31 this year show sales 35.5 per cent above the corresponding period of 1941. This applies to industrial gears only, not including automotive gears.